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ANNUAL REPORT

1963-1964

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DEPARTMENT OF AGRICULTURE

NEW SOUTH WALES

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30 APR 1965

1964

PARLIAMENT OF NEW SOUTH WALES

REPORT

OF THE

DEPARTMENT OF AGRICULTURE

FOR THE

Year ended 30th June, 1964

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AS AT 30th JUNE, 1964

DEPARTMENT OF AGRICULTURE*

Minister for Agriculture and Conservation	Hon. A. G. E. Enticknap, M.L.A.
Director-General	Dr. G. Edgar.
Director of Agriculture	Dr. H. J. Hynes.
Secretary	Mr. J. L. Hager.
Accountant	H. J. Chardon.
Administrative Assistant and Personnel Officer	S. W. Wise.
Pastures Protection Officer	J. B. B. Owen.
Legal Officer	S. T. Beal.
Architect	H. A. Browne.
Chief Biometrician	F. C. McCleery.
Chief Research Liaison Officer	Dr. S. L. Macindoe.
Division of Plant Industry—	
Chief	W. H. G. Poggendorff.
Deputy Chief	A. C. Orman.
Principal Agronomist (Pastures)	C. K. Vears.
Principal Agronomist (Research)	L. R. Kavanagh.
Principal Agronomist (Extension)	G. Nicholson.
Division of Horticulture—	
Chief	B. O. French.
Deputy Chief	J. A. Ballantyne.
Principal Fruit Officer (Extension)	R. G. S. Kebby.
Principal Fruit Officer (Research)	J. K. Long.
Senior Inspector (Export and Import Branch)	R. W. Robertson.
Division of Animal Industry—	
Chief	R. M. Watts.
Deputy Chief	R. A. Hall.
Director of Veterinary Research	J. C. Keast.
Principal Veterinary Research Officer	E. J. H. McBarron.
Chairman, Board of Tick Control	J. N. Henry.
Principal Veterinary Officer	N. K. Golding.
Principal Veterinary Officer (Meat Inspection)	R. C. Cramp.
Principal Livestock Officer (Sheep and Wool)	C. J. Hawkins.
Principal Livestock Officer (Beef Cattle, Horses and Goats)	W. J. B. Murphy.
Principal Livestock Officer (Pigs)	N. A. Steel.
Principal Livestock Officer (Poultry)	D. C. Duncan.
Principal Livestock Officer (Apiculture)	A. A. Clemson.
Division of Dairying—	
Chief	A. C. Small.
Deputy Chief	J. D. L. McGibbon.
Principal Dairy Officer	F. A. Vernon.
Principal Dairy Officer (Herd Improvement)	C. E. Chapman.
Principal Dairy Officer (Hawkesbury Agricultural College)	E. G. McLaren.
Division of Science Services—	
Chief	Dr. C. J. P. Magee.
Chief Biologist	W. S. Sutton.
Chief Entomologist	P. C. Hely.
Chief Chemist	T. H. Johns.
Director of the Royal Botanic Gardens and National Herbarium and Chief Botanist	H. K. Mair.
Division of Information Services—	
Chief	H. Parry Brown.
Editor of Publications	W. R. Turner
Organiser, Agricultural Bureau	J. J. Slater.
Senior Extension Officer (Women's Service)	Miss N. M. Foskett.
Research Liaison Officer (Scientific Publications)	J. N. Potter.
Libarian-in-Charge	J. C. Hazell.

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* For details of staff of the various Divisions, Branches, etc., see New South Wales Department of Agriculture brochure " Directory of Officers ".

For staff number totals see tabulation in this Report, page 22.

As at 30th June, 1964

Department of Agriculture—*continued*

Division of Marketing and Agricultural Economics—

Chief	C. J. King.
Principal Economics Research Officer	P. C. Druce.

Hawkesbury Agricultural College—

Principal	B. Doman.
Deputy Principal	B. F. Atkins.
Farm Supervisor	T. Adams.

Wagga Agricultural College and Experiment Station—

Principal	Dr. F. C. Butler.
Deputy Principal	J. R. Sutherland.
Farm Supervisor	J. G. Ballantyne.

Wagga Agricultural Research Institute—

Director	Dr. A. T. Pugsley.

Regional Extension Services—

Chief	J. L. Green.
Regional Supervisors of Agriculture—	
Southern Region	R. C. Madsen.
North Coast Region	S. R. Ballard.
Western Region	B. D. Ament.
South Coast and Tablelands Region	R. W. Shelley.
South-Western Region	G. A. Crawford.
Northern Region	G. R. Godden.
Mid-Coast and Hunter Region	H. A. Grantham.
Mid-Western Region	F. J. Nicholson.
North-Western Region	Vacant

Research Stations—

Chief, Research Stations Branch		A. Pearson.
Bathurst Agricultural Research Station	Manager	C. H. Mort.
Condobolin Agricultural Research Station	Manager	J. C. England.
Cowra Agricultural Research Station	Manager	J. M. Arthur.
Dareton Horticultural Research Station	Manager	J. W. Turpin.
Glenfield Veterinary Research Station	Director	J. C. Keast.
Grafton Agricultural Research Station	Manager	C. E. Collins.
Griffith Viticultural Research Station	O.I.C.	A. F. Murray.
Leeton Agricultural Research Station	Manager	C. R. Hood.
Narrabri Agricultural Research Station	Manager	F. W. Cutting.
Narara Horticultural Research Station	Manager	L. F. Mandelson.
Agricultural Research Station, Glen Innes	Manager	E. Tindale.
Poultry Research Station, Seven Hills	Manager	P. C. Smith.
Tamworth Agricultural Research Station	Manager	J. A. Loveridge.
Tamworth Agricultural Research Station	Director of Research	Dr. W. V. Single.
Temora Agricultural Research Station	Manager	R. Thomson.
Trangie Agricultural Research Station	Manager	J. H. Ballard.
Wollongbar Agricultural Research Station	Manager	F. A. York.
Yanco Agricultural Research Station	Manager	F. D. Mackenzie.
Alstonville Tropical Fruit Research Station	O.I.C.	D. S. Leigh.
Dairy Industry Research (North Coast)	Supervisor	W. J. C. Hudson.

NEW SOUTH WALES

DEPARTMENT OF AGRICULTURE

Report of the Director-General to the Minister for the Year ended 30th June, 1964

Department of Agriculture,
Sydney, 30th September, 1964.

Dear Sir,

Herewith the Report of the Department of Agriculture for the year ended 30th June, 1964.

CENTRAL ADMINISTRATION NOTES

The Seasons

The exceptions to mostly satisfactory rural conditions were some flood areas, and some parts of the Western Division where rainfall shortage was the dominant factor.

The 1963 winter temperatures were typical, and useful rain fell in most areas. Spring was in general mild until late November, when temperatures were high. Rainfall early in spring was mainly light but late in October almost every district received beneficial falls. November rainfall was in general below average except on the coast and in inland northern areas.

Warm to very hot weather continued over most of summer, with heatwaves late in December and early in January. Earlier in December most districts received almost a week of rainfall and many places had heavy falls. A tropical cyclone near mid-January brought heavy rain to most of northern N.S.W. It caused serious local floodings, mainly in the Namoi and Gwydir river systems. There were useful falls also at this time in some central districts. February was mainly dry, except on the north coast.

Autumn commenced with typical March heat but thereafter was mostly mild. Late May and June weather was variable, mostly cool and at times cold. Eastern areas received widespread rain early in March but no more until April. Above average April rainfall occurred in most districts. All districts received less rain than usual in May, as did northern and some southern areas also in June.

The Floods

When the central and south coast and parts of the adjacent tablelands experienced torrential rain in the second week of June, 1964, flooding was widespread along the lower Hunter and the Hawkesbury-Nepean River systems. There were minor floods on the south coast and central tableland.

Pastoral Position

In the second half of 1963, the pastoral position was satisfactory to very good in most areas. Main exceptions were the upper Western Division, and some of the north coast areas. The latter had been flooded earlier in 1963 and had yet to recover.

However, the mostly dry conditions during the first three months of 1964 caused the pastoral situation in general to deteriorate by early April, 1964. Exceptions included the more favoured northern areas. Rainfalls in late April and early May improved the position over much of the State, but because of the later cooler weather and frosts, subsequent pasture growth was mainly restricted to the improved grasses.

At the end of June, 1964, most districts were in good order with adequate feed available. Various central and south coast areas' pastoral situation was less satisfactory because of the excessive June rains. Most Western Division areas also remained unfavourable.

Stock watering supplies were generally adequate to ample during the twelve months, except between late February and mid-April in many of the drier districts. Livestock were mostly in good condition through the year, other than dairy cattle on lower river coastal farms which had yet to recover fully from the 1963 autumn floods.

At the end of June, 1964, stock were in good order in most districts, but in several areas supplementary feeding was necessary to maintain condition. In various far western, and some coastal and central areas, condition of stock was deteriorating as the 1963-64 year closed.

Commodity Notes

This was another good production year. Output of many commodities exceeded those of the previous season and some were records.

CEREALS

Wheat.—The 1963-64 wheat *grain* harvest totalled 122,472,000 bushels, the best ever; 13,470,000 bushels greater than the record achieved in 1962-63. It was the second successive year of N.S.W. production in excess of 100,000,000 bushels, and the fifth successive heavy crop. This 1963-64 output was some 37 per cent of the Australian production of about 330,000,000 bushels.

The yield average was also a record 24.67 bushels per acre; compared with the previous record—21.8 bushels per acre in 1962-63.

Production of wheaten hay in 1963-64 was 89,480 tons, a sharp reduction on the 123,160 tons from the previous season.

Wheat acreage sown for all purposes totalled 5,150,800; 4,963,800 acres sown for grain, over 57,000 acres for hay, and almost 130,000 acres for green fodder. Total acreage and the area sown for grain were only slightly below the previous year's figures. The total acreage was the fifth highest on record. Grain acreage was the fourth highest. Moreover, excessive rain in the sowing season reduced by 200,000 acres the area farmers had intended to sow.

Successful export marketing arrangements have assured that carryover into the next season will once again be normal.

Oats.—The oat *grain* harvest, 19,811,600 bushels, was considerably above the 16,035,000 bushels of the previous season and was the third highest on record. Yield average was 24.95 bushels per acre, the second highest. It has only been exceeded by the 1886-87 season. Oaten hay production was 99,660 tons, compared with 93,100 tons in 1962-63.

The oat acreage sown for all purposes was 1,515,500; 794,050 acres sown for grain, 63,750 acres for hay, and 657,700 acres for green fodder. The area sown for grain was the fourth highest on record.

Barley.—The barley *grain* harvest, 5,350,000 bushels, was slightly below the record production of 5,361,000 bushels in the previous season. Yield average was 25.3 bushels per acre, the second highest on record.

The area sown for all purposes was 250,530 acres; 211,560 acres for grain. Total and grain acreage were respectively only slightly below the record set by the previous season.

Maize.—The 1963 maize *grain* harvest, 2,089,200 bushels, was a little below the average of recent years. The area sown to grain was 44,680 acres. In 1962, production was 2,145,100 bushels from a sown area of 46,500 acres.

Grain Sorghum.—The 1963 *grain sorghum* harvest was 1,268,700 bushels, from a sown area of 61,200 acres; well below the record 1,890,800 bushels in 1962 from 80,200 acres.

Rice.—Preliminary figures indicate 1964 rice production as 139,800 tons, a new record. The 1963 output was 133,500 tons. Area under rice reached a record 59,390 acres, as against 54,930 in the previous season. Yield average was 2.35 tons per acre.

FRUIT

Pome.—Some 3,000,000 cases of apples and 650,000 cases of pears were produced; sustaining steadily increasing totals. Moreover, acreage figures for younger plantings show that the steady increases will continue for years.

Stone.—The crops were in general heavy, except for a below average apricot crop. The canning peach industry was notable for the high proportion of 1-5 year old trees (34 per cent), yet to come into bearing. These will increasingly swell production for the next few years. There is a strong move in the M.I.A. towards enlargement of cannery capacity to handle the increasing production.

Citrus.—Citrus crops were heavy for the third successive season and the output of 5,327,000 bushels was the second highest ever achieved. The record production of 5,465,000 bushels was obtained in the previous season (1962-63).

Table Grapes.—Production totalled near to 8,000 tons, a record for N.S.W.; as against 6,537 tons in 1962-63. Further, the non-bearing percentage of total acreage has risen from 8.5 per cent in 1962 to 15.4 per cent in 1963; sufficient to steadily increase annual production.

WINE

Production of wine grapes for the 1964 vintage has been estimated at 36,500 tons, a record. The previous record was 34,028 tons, in 1963.

Wine production has been estimated at 6,150,000 gallons; compared with 5,878,178 gallons in 1963. Of note, the M.I.A. in 1963 produced 20 per cent of Australia's wine; as against 14 per cent in 1960.

MEAT PRODUCTION

Preliminary figures indicate that 1963-64 production amounted to approximately 281,900 tons of beef and veal, 203,500 tons of mutton and lamb, 28,800 tons of pigmeats, and 13,500 tons of bacon and ham. Comparative production figures for 1962-63 were 263,000 tons of beef and veal, 198,850 tons of mutton and lamb, 30,300 tons of pigmeats and 12,740 tons of bacon and ham.

Production of beef and veal, mutton and lamb and bacon and ham were each a record. Pigmeat production other than bacon and ham was about average.

DAIRY PRODUCTS

Wholemilk production reached 328,000,000 gallons, compared with 324,000,000 gallons in 1962-63. The N.S.W. Milk Board continued to increase purchases for its expanding area; purchasing about 93,000,000 gallons in 1963-64, compared with 90,000,000 gallons in 1962-63.

Factory butter production was in the vicinity of 36,100 tons and cheese production almost 5,150 tons; compared with 35,970 tons of butter and 5,300 tons of cheese in the previous 12 months.

EGGS

Commercial egg production amounted to 56,713,000 dozen, compared with 54,609,000 dozen in 1962-63. However, the output was well below the record 62,160,000 dozen in 1960-61.

WOOL

First hand deliveries of wool from the 1963-64 clip into the three main New South Wales stores at Sydney, Newcastle and Goulburn, totalled 1,606,409 bales during the twelve months ended June, 1964; equivalent to about two-thirds of the State's total clip. Total receivals during the 12 months were 1,703,175 bales, including the carryover from the previous season and wool received for re-sale, and 1,615,815 of these were sold. After excluding 19 bales shipped abroad for sale during the season, 87,341 unsold bales were held in store at the end of June, 1964.

In each case, the figure was higher than in 1962-63. In particular, the quantity sold through the three stores was the highest since 1959-60. This increase in sales, together with an increase in the average price of wool from 59.5d. per lb. greasy in 1962-63 to 70.3d. per lb. in 1963-64, resulted in the value of sales totalling £142,500,000; compared with £115,200,000 in 1962-63.

The value of wool sold through these three stores was the highest since sales in 1956-57 returned £166,300,000.

Livestock Numbers

Sheep and Lambs.—At the end of March, 1964, sheep and lambs in New South Wales totalled a record 71,764,000; an increase of 1,743,000 over the 70,021,000 in March, 1963. Sheep numbers rose to 55,754,000 and lambs to 16,010,000. The proportion of lambs marked (20,881,000) to ewes mated (27,548,000) was 76 per cent.

Cattle.—Cattle in New South Wales at the end of March, 1964, totalled a record 4,789,000; an increase of 220,000 over the previous record 4,569,000 in March, 1963.

Pigs.—Pigs in New South Wales at the end of March, 1964, totalled 391,000; a decrease of 700 as compared with the previous year.

Fodder Conservation Trends

The conditions led to further build-up of farm reserves of hay and silage. The reserves are now higher than at any other period in the State's history. Hay reserves have increased to an estimated 1.6 million tons, and silage to an estimated 603,000 tons. There are also large farm reserves of grain, though precise statistics are not yet to hand. Importantly, today a large proportion of the farm-stored grain is effectively bulk-stored in galvanised iron silos. The area sown to improved pasture has meantime become 10.18 million acres.

Since the mid 1940's sheep numbers have increased by 26 per cent to 71.7 million and cattle by 65 per cent to 4.7 million. Factors including effective rabbit control, improved stock watering supplies, sub-division, improved road and rail facilities for rapid movement of stock, and changed stock-feeding techniques have all helped to lessen the effects of dry periods on stock numbers and their production potential. Because of these factors, and absence of drought, there are of course some stock owners who have been lulled into false security.

The test of efficient utilisation of existing fodder reserves and effective management will be made when a major drought occurs.

Increased interest in artificial drying of hay and grain by electric and diesel powered units has been obvious, but problems have to be solved before artificial crop-drying becomes commonly accepted into normal farm practice.

It has appeared in these early stages of acceptance that drying of grain intended for seed will be favoured by seed producers. When this facet of grain drying is firmly established the next stage might be application to commercial batches of grain and hay intended for human and stock consumption.

Superphosphate Trend

Increased demand for superphosphate, exceeding all expectations, created problems both for manufacturers and farmers. Production of superphosphate in New South Wales in 1962-63 was 488,000 tons, and in 1963-64 increased by 36 per cent to 662,000 tons. To that figure of 662,000 tons must be added the quantities supplied from Victorian and Queensland distributors to farmers in border districts; approximately another 50,000 tons.

If supplies had been freely available, New South Wales consumption this year would have been even 100,000 tons greater, probably totalling 800,000 tons.

Factors contributing to the sudden, greatly increased demand for superphosphate are: the Commonwealth Bounty of £3 a ton, payable as from 14th August, 1963; buoyant markets for wool, wheat and beef; favourable conditions for growth of crops and pastures and for spreading superphosphate from the air; and landholders' growing appreciation that fertilizer application plays a vital role as an aid to increased production.

No doubt, publicity given to relative shortage of superphosphate tended to inflate demand. The suddenly increased demand caught manufacturers unprepared. Consequently shortages occurred in many areas during the autumn and early winter of 1964.

There was concern that superphosphate distribution would be insufficient for wheat growers' needs during the main sowing months—April, May and June. Near to 30 per cent of superphosphate supplies are used for crop production and the rest for pasture topdressing. Some shortages for wheat crops did occur but the position was not critical. Farmers met the situation in various ways. Some delayed sowing until supplies became available; others sowed with reduced fertilizer rates; relatively few failed to use superphosphate in districts where its use is established practice.

There is increased appreciation of the value of superphosphate to boost crop yields in northern areas. There, some farmers were unable to secure full fertilizer requirements.

Sales of bulk superphosphate continued to increase. In 1962-63, 52 per cent was sold in bulk. By 1963-64 this had increased to 62 per cent.

Australian Agricultural Council and Standing Committee on Agriculture

The Australian Agricultural Council met on two occasions; in July, 1963, at Brisbane and in February, 1964, at Hobart. There was only one meeting of the Standing Committee on Agriculture; at Hobart in February, 1964.

The important topics discussed included: stabilisation plans for wheat; dried vine fruits; egg and potato industries; Commonwealth-State Meat Inspection Services; aerial agriculture; tractor testing; cotton and tobacco growing; economic surveys of potato, citrus and canning peach industries; meat marketing.

Farrer Memorial Trust

Three ordinary meetings and an annual meeting of the Trustees of the Farrer Memorial Research Scholarship Fund were held.

The 1963 Farrer Memorial Medal was awarded to Professor R. N. Robertson, Professor of Botany, University of Adelaide. The Oration entitled "Phytotrons, Spectrophotometers and Productivity" was delivered by Professor Robertson at a special session of A.N.Z.A.A.S. held at Canberra on 23rd January, 1964.

Professor C. M. Donald, Professor of Agriculture, University of Adelaide was awarded the 1964 Farrer Memorial Medal. At the close of the period under review, preliminary arrangements had been made for the Oration to be delivered at a function in association with the Australian Institute of Agricultural Science (N.S.W. Branch) during September, 1964. Professor Donald had not yet chosen the subject of his Oration.

The 1964 Farrer Memorial Research Scholarship was awarded to Mr. M. R. Krause, Vice-Principal, Roseworthy Agricultural College, South Australia, who is also Lecturer-in-Agriculture and Senior Plant Breeder. Mr. Krause will study problems associated with wheat breeding, and also modern methods of pure seed production, at Washington State University, Pullman, Washington, U.S.A.

The accounts of the Trust were audited and found satisfactory by the Auditor General of N.S.W.

Royal Botanic Gardens and Government Domain Trust

Trustees of the Royal Botanic Gardens and Government Domain met on one occasion during the year.

Amongst the matters considered by the Trustees were: a proposal for establishment of a heliport in the Domain; proposed extensions to the Travers Pavilion at the rear of Sydney Hospital; restoration of the area in the vicinity of the Domain Car Parking Station; car parking facilities in the Domain. The consent of the Trustees was given for holding a ceremony in the Domain to welcome the vessel "Krait".

Overseas Visit by the Director-General

The Director-General was overseas from 7th August to 22nd October, 1963, primarily as leader of the Australian Delegation at the XVIIth World's Veterinary Congress at Hanover, West Germany, in August.

He also attended a Conference on Animal Production at Rome in September, and subsequently visited research workers at a number of centres in the United Kingdom, Europe and the United States of America.

Whilst in the United Kingdom, he attended the British Veterinary Association Congress at Llandudno, Wales; in the United States of America, he conferred with research workers at the Rockefeller Institute, in particular with Dr. R. Shope who visited Australia in 1962 at the invitation of C.S.I.R.O. and the Victorian and New South Wales Governments to report upon rabbit control and the use of myxoma and fibroma viruses in Australia. Subsequently the Director-General had discussions with other workers regarding control of sheep Blue Tongue. There is constant threat of introduction and establishment of this disease in the sheep population of Australia.

Finance—Summary

Consolidated Revenue Fund Expenditure and Receipts.—Expenditure from the Consolidated Revenue Fund in 1963-64 was £5,876,529. This included £995,800 for cattle tick control on the north coast and £181,157 for upkeep of the Royal Botanic Gardens and Admiralty House; each of these is recouped, in part, by the Commonwealth Government.

Further details in support of the Consolidated Revenue Fund expenditure, and of expenditures by other Government Departments on behalf of the Department of Agriculture, are shown in the Public Accounts tabled in Parliament each year as an accompaniment of the Report of the Auditor General.

Receipts from all sources, totalling £2,688,151, are shown in some detail later in this Report (*Appendix* I—The Accounts of the Department of Agriculture, 1963-64).

Capital Works.—Capital works to the value of £158,854 were constructed and a Loan programme of £260,000 has been prepared for 1964-65. Details of Loan works expenditures during 1963-64 are shown in *Appendix* I—The Accounts of the Department of Agriculture, 1963-64.

A grant of £40,000 was received for the relief of unemployment and this sum was also expended on capital works during the year.

Trust Funds.—The provision of funds by industries, by semi-government sources, by Commonwealth Government grants and by specialised taxations continued in the upward trend of recent years. Substantial sections of the research programmes have been financed in this way, and findings have been extended to the primary producers and others with the help of special Commonwealth grants (*vide* "Commonwealth Extension Services Grant" and "Commonwealth Dairy Industry Extension Grant").

Expenditure from such grants or trust accounts is handled through the "Special Deposits Accounts" at the Treasury and regulated by Act of Parliament or such direction as may be given by the donor body, to whom the Department of Agriculture must account at the close of each financial year.

Some of the more important aspects of Special Deposits Account operations are given in *Appendix* I—The Accounts of the Department of Agriculture, 1963-64.

Commonwealth Grants for Extension Services

Agricultural Extension Services Grant.—The Commonwealth Agricultural Extension Services Grant is a sum of £300,000 made available to the States for annual expenditure to assist agricultural extension services not concerned with the dairying industry or wool production. The dairying and wool industries are covered by other annual grants. The Agricultural Extension Services Grant has operated since 1952, in amounts varying between £250,000 and £350,000 per annum, but since 1960 has been £300,000 per annum. The annual allocation to N.S.W. is now £75,000. The total of expenditure by the N.S.W. Department of Agriculture from 1952 to 30th June, 1964, from the Agricultural Extension Services Grant is £761,488.

This Grant being due to terminate on 30th June, 1965, a submission has been made recommending continuance for a further five years to 30th June, 1970, and that the amount to the States as a whole be increased from £300,000 to £400,000 per annum.

Dairy Industry Extension Services Grant.—The Commonwealth Government makes available to the States a sum of £350,000 for annual expenditure to assist extension services in the dairying industry. The Grant commenced in 1948 and has been renewed at five year periods. Prior to 1st July, 1964, the amount was £250,000 per annum. At that date the Grant was renewed for a further five years to 30th June, 1968, and increased to £350,000 per annum. Annual allocation to N.S.W. is now £89,000.

This annual grant since 1948 has totalled £1,032,303 to 30th June, 1964. It has *inter alia* provided the means for great numbers of demonstrations on farms; also for appointments of advisory staff and provision of extension aids for officers in dairying districts.

Industry Funds for Research

The Department has continued to receive from industry committees reasonable allocations of funds raised by levy on wheat, wool, dairy products, beef and tobacco. It now receives over £200,000 annually from the several industry research funds.

Provision of industry funds for research has arisen at a most opportune period, as this Department now has a number of appropriate and well placed research stations. The provision of funds for additional staffing and facilities at these has accelerated the expansion and improvement of the Department's regional and adaptive research programme. *Inter alia*, some of the experienced research personnel now have enhanced effect because of appointment of additional, less experienced research personnel or technical assistants, under their control and direction.

Support this year continued for most projects approved earlier, but in the case of the Soft Wheat Quality Project the Wheat Industry Research Committee declined to make further allocations during 1964-65. On the other hand, the Australian Cattle and Beef Research Committee actually requested the Department to submit, additional to those originally submitted to it for support in 1964-65, further research projects for its consideration.

The Industry Research funds made available to the Department during 1963-64 for expenditure were allocated as follows:—

WHEAT INDUSTRY RESEARCH COMMITTEE FUNDS

Wagga Agricultural Research Institute Project.—Agronomic survey (£5,300); breeding of improved wheat varieties for irrigation areas (£2,400); soil fertility (£1,000); skeleton weed (£700); quadrumat junior mill (£950); genetic analysis of maturity (£1,800); laboratory equipment (£3,000); and travel and capital expenditure (£1,700).

Tamworth Agricultural Research Station Project.—Insulation and refrigeration of glasshouse (£1,200); and mechanism of frost resistance in wheat (£650).

Entomology Branch Project.—Black soil scarab research (£500).

Condobolin Research Station Project.—Wheat research for central west (£10,000).

In addition to the above a substantial balance of funds unspent at 1.7.63 remained available for use.

WHEAT INDUSTRY RESEARCH COUNCIL FUNDS

Wagga Agricultural Research Institute Project.—Wheat geneticist scholarship (£1,500); and agricultural research equipment (£1,500).

Tamworth Agricultural Research Station Projects.—Photoperiod and temperature studies (£3,746); and research equipment (£5,000).

Chemistry Branch Project.—Wheat grading survey (£3,560).

WHEAT INDUSTRY STABILISATION (DISPOSAL) FUND

The Department received from the Minister for Primary Industry approval for expenditure of £67,230 on the following research projects:—Investigations of accuracy and usefulness of soil phosphate tests for yield production of wheat (£16,000); mobile equipment for nutrition and plant breeding work at the Agricultural Research Station, Tamworth (£5,000); control of skeleton weed in areas of summer rainfall (£12,088); cereal chemistry research unit at the Agricultural Research Station, Tamworth (£13,942); purchase of additional land for the Agricultural Research Institute, Wagga (£9,500); and controlled environment equipment for Castle Hill Research Station, University of Sydney (£10,000).

The £50,730 remaining is available for investment by the Department, the interest on investment to be used for further research projects as approved by the Minister for Primary Industry.

WOOL INDUSTRY RESEARCH COMMITTEE FUNDS

Trangie Agricultural Research Station Projects.—Deficiency of wool production (£1,950); influence of season on ram fertility (£700); galvanised burr (£50); fleece measurement for selection of stud merino rams (£7,000); and comparison of management systems (£3,750).

Glenfield Veterinary Research Station Project.—Itchmite in sheep (£722).

Entomology Branch Projects.—Sheep blowfly (£1,750); and black soil scarab (£1,670).

Shannon Vale Nutrition Station Project.—Relative efficiency at several stocking rates and superphosphate levels (£5,300).

Yass Valley Project.—Adaptive pasture research, Southern Tablelands (£2,800).

AUSTRALIAN CATTLE AND BEEF RESEARCH COMMITTEE

Grafton Agricultural Research Station Projects.—Pasture species investigations, with particular reference to summer legumes (£5,680); and phosphate levels in North Coast soils, with specific reference to summer legumes (£3,190).

Tamworth Agricultural Research Station Project.—Major and minor element deficiency in soils from beef areas (£4,040).

Leeton Agricultural Research Station Project.—Pasture intake and digestibility studies (£4,070).

Glen Innes Agricultural Research Station Project.—Winter nutrition on the Northern Tablelands (£6,540).

Trangie Agricultural Research Station Project.—Beef cattle improvement through breeding methods (£7,440).

Division of Marketing and Agricultural Economics Project.—Nature and organisation of the Australian Beef Cattle Industry (£2,550).

AUSTRALIAN DAIRY PRODUCE BOARD FUNDS

Wollongbar Agricultural Research Station Projects.—Socio-economic investigations (£6,650); pasture species research (£5,175); and other pasture and animal research (£6,878).

Hawkesbury Agricultural College Projects.—Efficiency of detergents and sanitisers (£2,200); and composition of milk (£6,245).

Biology Branch Project.—Bacteriophage antibiotic interactions (£3,000).

TOBACCO INDUSTRY TRUST ACCOUNT

Glen Innes Agricultural Research Station Projects.—Expenses for current research at Glen Innes and the adjacent tobacco growing areas (£24,000); and purchase of initial equipment of a new Tobacco Experiment Station at Ashford (£32,000).

BANANA RESEARCH ADVISORY COMMITTEE

Research into mixed ripe, packaging, handling, and ripening of bananas (£3,148).

Research Liaison Office

Progress of individual research projects is reported by the various Divisions and Institutions which assume the direct responsibility for their research programmes.

Scope.—The Chief Research Liaison Officer is responsible to the Director of Agriculture, for improvement of existing research, stimulation of new research programmes, and co-ordination and integration of research—especially where the subject matter concerns more than one Division. He helps also to assure that the results of research are presented effectively. He has a specific responsibility to stimulate, and present for consideration, research projects likely to attract Industry Funds for research (see p. 18).

Research Programme Committees.—Within the Department, Programme Committees have been established relative to the beef cattle, cotton and dairying industries. The respective Committee is to review problems facing the industry, and consider research work required. Following are the responsibilities of each Committee:—

Define the main problems facing the industry, and indicate an order of priority and importance.

Define the fields of research responsibility relative to Divisions of the Department and other organisations, e.g., the C.S.I.R.O., other State Departments, Universities, etc.

Review the work of present research teams, relating their projects to the stated problems; and suggest whether replanning of work to meet the needs is advisable.

Based on this review, recommend projects to be undertaken in the immediate future.

Submit the report of their deliberations to the Chiefs of Divisions concerned, and thence to the Director-General.

Hold an annual meeting of the Committee at an appropriate industry period, to review progress and the submitted reports.

Establishment of A.D.P. Section.—An Automatic Data Processing Section comprising a Systems Officer and a Programmer has been established in the Department. At present the Section has the part-time assistance of two members of the Public Service Board's A.D.P. Division.

The new Section began operation as a unit within the Department on 13th April, 1964. It is currently transferring the herd production improvement scheme work of the Division of Dairying to automatic data processing, using the Honeywell Computer located at the Public Service Board's A.D.P. Centre.

Wagga Agricultural Research Institute Additions.—Tenders have been let for erection of additions to the Agricultural Research Institute, Wagga, to allow expansion of research work into soil fertility problems. Of the £72,266 expenditure, £8,000 was provided by the Wheat Industry Research Council and £5,000 by the N.S.W. Wheat Industry Research Committee.

Tamworth Agricultural Research Station Developments.—After a two years lag it has become possible to fill the long-standing three additional senior research positions at this Station, viz. for pasture research, plant nutrition and cereal chemistry.

The Station is situated on the fringe of the northern wheatgrowing areas, recognised for their high baking quality wheats. Cereal chemistry research equipment to the value of about £19,000 will shortly be installed. Of this amount £5,000 was contributed by the Wheat Industry Research Council. The remainder came from Wheat Industry Stabilisation Funds.

Research Liaison Officer (Science Publications) Appointed.—Appointment of this officer is reported under Division of Information Services. A section has been established in the Agricultural Gazette to emphasise the Department's research work.

"Research and the Farmer"—Regional Publication Series.—Following publication of the first of a new series entitled "Research and the Farmer—No. 1, For Southern Agricultural Region", several other Regions are preparing material for further issues of "Research and the Farmer" for Regional distribution. Copy for No. 2, also "For Southern Agricultural Region" is now to hand for printing.

The Agricultural Colleges' Entrance Standards

Agriculture Diploma Entrance Standards and Enrolment Procedure

Following implementation of the Wyndham Report in Secondary Schools, changes in minimum entry standards for the Agricultural Colleges' Diploma courses were foreshadowed. The new minimum entry standards, and new procedure for enrolments, to operate in 1966 and thereafter, have been determined, as follow:—

(a) Students will be selected on merit.

(b) Applications for admission 1966 and thereafter will be accepted only in the preceding calendar year, and application closing date will be 30th September.

(c) (i) Each applicant must be not less than 17 years of age at date of commencement of the first term. Only if insufficient applicants offer will this minimum age be waived. Preference would then be given to applicants closest to 17 years of age.

(ii) Each applicant must possess the School Certificate issued by the N.S.W. Department of Education, or an equivalent. He must have passed that examination in at least five subjects. These must include English, Mathematics and Science. In addition, at least two of the five passes must be at the advanced level.

If the number of applicants with the minimum qualifications exceeds the available vacancies, preference will be given to:—

(1) those who have successfully completed one or two further years of secondary education and as a result hold the Higher School Certificate or the present Fifth Year Leaving Certificate, or who have successfully completed Fifth Year Secondary Schooling.

(2) those who have gained useful experience for a year or more on farms.

(3) Any remaining places to be determined on merit, from the School Certificate examination order of merit list.

(d) Applicants with the entrance requirements who do not gain selection in a particular year may re-apply for a subsequent year but by then (1) must have successfully progressed further in secondary education *or* have gained acceptable experience fitting them better to pursue the course desired, *and* (2) must re-apply before 30th September of the application year concerned.

Farm Certificate Course, Yanco

Building work now in progress will ensure accommodation for 100 students at Yanco Agricultural Research Station. The work will cost £160,000.

The Farm Certificate Course conducted there by the Department of Agriculture has developed rapidly since its introduction in 1963. In that year 38 students were accepted; in 1964 the number was increased to 55; present indications are that the increased accommodation providing for 100 students will be barely sufficient for the 1965 course.

The course has been specially designed for farmers' sons and others who intend to go on the land, either as property owners or managers. Practical training in farm skills has been combined with agricultural "theory".

The curriculum provides subject matter concerned with cereals, fodder crops, pastures, sheep and wool, beef cattle, dairying, horticulture, irrigation farming, economics and farm management, animal health, and farm machinery—including welding.

Some Developments Affecting Field Crops and Pastures

Wheat Industry Stabilisation Act, 1963

The Wheat Industry Stabilisation Act, 1963, was assented to on 9.12.63. For New South Wales this extended for a period of five years the scheme for the orderly marketing of all wheat through the Australian Wheat Board. It also continued the previous arrangements for a guaranteed price for a specific export quantity and for fixation of a home consumption price.

Departmental Wheat Executive Established

In August 1963, the Director-General approved the setting up of a Departmental Wheat Executive, to control all research and other work relating to wheat by the various Divisions, Sections, Institutions of the Department. The Executive comprises the Director of Agriculture, the Chief, Division of Plant Industry, the Chief, Division of Science Services, the Chief Research Liaison Officer, and the Special Agronomist (Cereals).

Expansion of Wheat Research in Central West

A wheat research agronomist has been appointed, stationed on Condobolin Research Station, to investigate in conjunction with Division of Science Services Chemistry Branch, the response of wheat to fertilizers and the value of soil tests to determine rates of fertilizer applications. The research agronomist will also supervise the established Condobolin Soil Fertility and Rotation Experiment, enabling greater attention to this important project.

These developments in the central west are part of the effect of a £30,000 grant, from the Wheat Industry Research Committee, for expanded wheat research in that sector of the wheat belt. The Advisory Committee of the Mid Western Region of the Department's decentralised administration has been closely associated with submissions which led to the grant.

WHEAT QUALITY COMMITTEE'S REPORT PUBLISHED

The New South Wales Advisory Committee on Wheat Production and Marketing completed its main task and submitted its report to the Minister. The Minister approved its publication in November, 1963. The Committee was set up to investigate wheat quality problems as affecting production and marketing.

Consistent with one of the main conclusions of the report, variety recommendations for 1964 wheat sowings were for the first time made with definite regard for confinement of hard and soft varieties in separate zones. The Committee's recommendations have been designed to align to the demands of the market all phases of wheat production—from research, breeding, testing, release and recommendation of new varieties, to commercial cultivation.

IMPROVEMENTS ON POPULAR WHEAT VARIETY HERON

Released in 1958, the variety Heron so rapidly increased in popularity that by 1963 it is a N.S.W. leading variety in terms of acreage.

Heron is high yielding, adapts well to a wide range of sowing times, and even under severe conditions it usually finishes well. It is the first bunt-resistant variety released in Australia since William Farrer released Florence more than 60 years ago.

The Agricultural Research Institute, Wagga, reports that a great deal of work has been undertaken in the past six years to further enhance Heron's characteristics. As a result, new improved strains of Heron are likely to be available for release in 1966.

TWO NEW WHEAT VARIETIES RELEASED

Two important new wheat varieties were released, recommended for northern New South Wales. Both are rust resistant and of acceptable grain quality.

Festiguay, developed by the Department of Agriculture at Tamworth Research Station, is an early-sowing wheat. It is of semi-winter habit, and could therefore be sown early with little likelihood of winter damage by frosts.

Mendos, developed in the University of Sydney northern wheat-breeding programme, is a late-sowing wheat of the Gabo type. It is equivalent in yield and superior in grain quality to the now widely grown Mengavi.

ADVISORY SOIL TESTING SERVICE

Early work at the Agricultural Research Institute, Wagga, on phosphorus fertilizers in relation to wheat production has recently been extended by the C.S.I.R.O. Now an advisory service to farmers, based on soil analysis, has been commercially introduced. The Department is vitally interested in this development but considers that further studies are needed. Accordingly, a Pilot Testing Scheme has been established at Wagga Wagga, with a view to determining how best to use modern knowledge from fertilizer research in the farmer advisory service. A three-year programme has been commenced. It involves studies on analytical procedures, and their calibration with results from additional field trials.

RICE—ANOTHER RECORD YEAR

The rice industry in New South Wales, long recognised as one of Australia's most efficient agricultural industries, this year achieved the new record total production of 140,000 tons. This was the third successive record total harvest.

The industry has recorded many significant achievements in the past ten years. Total harvest has been doubled. Yield averages have grown to about 140 bushels per acre. The record for a single season stands at 150 bushels per acre, and for a single crop at 240 bushels per acre. These yields are higher than recorded in any other rice-growing country.

The research and extension programmes conducted by this Department have contributed largely to the achievements. Rapid advances in industry efficiency have stemmed from those programmes and the high level of co-operation by rice grower organisations—assuring ready grower-acceptance of the advances made by research.

RICE BREEDING'S OUTSTANDING ACHIEVEMENT

Rice growing in New South Wales had been based on the high yielding, short-grain variety Caloro II until in recent years the changes in consumer tastes at home and abroad made necessary the development of other types of rice. The American medium-grain type Calrose proved highly acceptable, especially after intensive local selection.

Bluebonnet 50, a long-grain "indica-type" was most suitable of the long-grain varieties available from overseas but comparative yields remained inferior despite careful selection and the variety did not possess the high quality required. A long-term breeding programme was therefore commenced, to develop a replacement for Bluebonnet 50.

This season's yield tests of several advanced crossbreds have revealed that all lines are far superior to Bluebonnet 50 and that four of them approach the Calrose and Caloro II yields. Levels of 4 tons per acre were achieved, far in excess of the world-wide accepted yield limits for an "indica-type".

COTTON'S INCREASE

The 1963-64 cotton crop in New South Wales is believed to have yielded some 7,000 bales of lint from some 7,600 acres harvested. Many crops average 1½ bales per acre, and at least one crop yielded 2 bales per acre. These were highly satisfactory results in view of the adverse season, the relative lack of experience with such a new and specialised crop, and the large number of problems faced by farmers and still being investigated. Actually 11,000 acres were sown but acreage losses amounted to about 4,000 through flooding, weeds and very late sowings.

Intended sowings for the forthcoming season indicate at least 22,000 acres, and this upward trend will continue. A striking aspect of this development is that the cotton industry in N.S.W. is based entirely on irrigation. This offers the industry stability and profitable production.

There are now three ginneries in the cotton districts of the State, two more having been constructed during the past season. The lint gradings from the 1963-64 crop have been most encouraging.

The changed basis for bounty payments from seed cotton to lint quality, designed to improve the quality of Australian-grown cotton, has been welcomed by the industry.

Consistent with the recognised need for high lint quality, the Department has recently appointed an Officer-in-Charge for the Cotton Fibre Testing Laboratory to be constructed at Rydalmere.

INCREASED PRODUCTION OF CERTIFIED AND OTHER PASTURE SEED

The year provided a new peak in production of certified, pasture plants seed; 2,406 tons of certified seed, as against 1,569 tons the preceding year. The season was very favourable to subterranean clover production, but there were also large crops of other certified species.

Farmer interest in certified seed is indicated by the increasing number of certified species and varieties, such as the new tropical legumes and new varieties of cocksfoot and fescue. Commercial production of *Glycine javanica, Dolichos lab lab, Desmodium uncinatum*, Siratro, *Lotononis bainesii*, Brignoles and Currie cocksfoots and Demeter fescue is now established. Certification schemes for these are being requested by farmers.

A feature is that current development is towards specialised seed production, in lieu of the standard practice of harvesting seed from surplus areas not grazed.

Considerable quantities of subterranean clover and *Phalaris* seed were exported, particularly to South America, and inquiries are increasing.

The local interest in seed production is accelerating commercial utilisation of the results of pasture-plant improvement programmes.

COMMERCIAL ACCEPTANCE OF NEW PASTURE PLANTS

Even at the present high prices, farmer demand for seed of the new plants mentioned in the foregoing note are strong. Some 1,500 acres of the perennial summer legumes have been sown on the north coast, in areas extending from Taree to the Queensland border. Rapid expansion of use of these new pasture species is expected, as seed becomes more freely available and more is known about their establishment and utilisation.

Irrigation Trends

Intense interest in potential irrigation development by large financial interests of American origin has been notable. There have been significantly numerous inquiries from individuals, groups, and land companies, all interested in making investments within this State—mainly in irrigated cotton-growing.

There has been dramatic increase in recent years in number of farms with irrigation facilities, and the trend continues. Latest published figures of the N.S.W. Water Conservation and Irrigation Commission (Annual Report 1962-63) show about 14,200 farms with irrigation facilities. Thus, there being approximately 78,000 farms (of one acre or more) in the State, 18.2 per cent are already wholly or partly irrigated.

Automatic Irrigation Control

The Division of Science Services Chemistry Branch has made progress towards equipment for automatic control of irrigation. Gypsum blocks ("Moistests") are used in conjunction with an electronic control unit powered by a 12-volt battery.

Weeds

EFFECTIVE CONTROL OF SERRATED TUSSOCK

Effective control on non-arable areas by use of aircraft was well demonstrated at field days held at Rockley and Porter's Retreat during November, 1963. In separate trials, large areas had been sprayed from the air in 1962 and seeded the following winter while similar trials were repeated during 1963.

The techniques developed in small scale trials in previous years, spraying in summer with 2,2-DPA at from 20-30 lb. per acre and the sowing of clovers and grasses with fertilizer during the early winter, were done on a field scale with aircraft. This gave a remarkable demonstration of high-percentage, serrated tussock kill and effective replacement by vigorous pasture mixtures.

The methods have shown that serrated tussock can be controlled and replaced by productive pastures over large areas of non-arable land at reasonable cost. Subsequent to the demonstration, 582 acres were sprayed commercially by 12 landholders and the Forestry Commission.

THE NOXIOUS PLANTS INVESTIGATION COMMITTEE

This Committee, set up during the previous year to investigate and report on the administration of control and eradication of noxious plants within the framework of Local Government, presented a majority report to the Minister for Local Government and the Minister for Agriculture on 15th May, 1964.

The Committee's recommendations envisaged an integrated development based on education, regulation, co-ordination and finance. Advice has been received that the report has been adopted in principle.

Some Developments Affecting Fruit Industries

QUEENSLAND FRUIT FLY WHOLE-TOWN CONTROL PROJECTS

The scheme for whole-town suppression of fruit fly in the Murrumbidgee Irrigation Areas and at Narrandera and Hillston, in co-operation with Local Government councils, continued successfully. No infested fruit was found in any of the towns concerned, and except for four adults at Narrandera no fruit flies were trapped.

The scheme was extended to Hay in the 1963 winter, on the initiative of the Hay Municipal Council. In consequence, only 24 fruit flies were trapped between July, 1963, and April, 1964, compared with 717 for the same period in the previous year; and only a few fruit were infested.

A total of 16 Councils adopted the whole-town spray baiting scheme. The Councils are appreciative of the considerable success achieved and of the assistance given to them by the Department.

DWARF CITRUS TREES FOR LOWER PRODUCTION COSTS

That citrus tree size can be controlled where the root stock is trifoliata, has been demonstrated in investigations by the Department's Citrus Improvement Committee.

A further planting of various selections of dwarf citrus trees has been made at Yanco Agricultural Research Station. Reduced costs of fruit production, through simpler spraying and harvesting operations in particular, are the main aim. Whether the close-planting of dwarf citrus trees will be an economic proposition for citrus growers is to be assessed.

The plantings at Yanco have attracted considerable interest, particularly from overseas visitors. It would seem that they are the first of their kind in the world.

BANANA QUALITY RESEARCH

To improve the consumer-quality of bananas the Department is co-operating in a research programme on post-harvest handling problems. An additional research officer has been appointed to the Tropical Fruit Research Station, Alstonville, for this work. Funds have been made available by the industry and the Commonwealth Government through the Banana Research Advisory Committee.

Phylloxera-RESISTANT ROOTSTOCK SERVICE

Sales of the Department's *Phylloxera*-resistant grape rootstocks for the 1963 planting season totalled 23,640, compared with 19,974 in 1962. Sufficient were available to satisfy the demand for all varieties. The total sold was far below earlier years' sales, which average about 40,000. This is explained by the fact that in *Phylloxera*-infested districts the urban development has been so pronounced that grape-growing has declined there.

IMPROVED TECHNIQUES FOR PLANT TISSUE ANALYSES

Analytical techniques based on atomic absorption spectrophotometry have been adopted by the Chemistry Branch for calcium, magnesium, manganese, sodium, potassium, iron, zinc and copper determinations in plant material.

A new method for determining zinc has been developed using the polarograph and a resin column, eliminating interferer substances.

Some Developments Affecting Livestock Industries

INSECTICIDE RESIDUE PROBLEMS FROM PASTURES

A decision was made this year to remove from Departmental recommendations the application of cyclodiene insecticides to pastures or feed crops. Dieldrin and aldrin are two of the best-known. They may still be used, however, as soil applications prior to or at sowing—for control of black beetle, white fringed weevil or clover root weevil.

Research to find alternative pest control measures, to avoid chemical residue hazards in the tissues or products of stock grazed on pastures treated with chlorinated hydrocarbons, has progressed satisfactorily. (See report of Entomology Branch.)

SWINE FEVER

An outstanding feature this year was the total absence of any outbreaks of swine fever. There has been no case since the outbreak in November, 1962. It is therefore believed that clinical swine fever has been eradicated from the State.

Reactions to the gel diffusion and serum neutralisation tests have revealed positive reactors in herds where there have been no suspicious symptoms. The significance of these reactions is not known.

CAUSES OF NEONATAL LAMB LOSSES

Toxoplasmosis and enzootic virus abortion were found for the first time to be causing neonatal lamb losses. Presence of these diseases had been previously suspected.

BOVINE TUBERCULOSIS—ERADICATION MEASURES

Tuberculosis eradication measures were greatly expanded during the year. Seventeen more quarantine Areas wherein TB testing of cattle is compulsory were declared. The total of such Areas is now 49 and 965,000 head of cattle are involved in them.

Selective Merino Sheep Breeding

At Trangie Agricultural Research Station the high heritability of fleece-weight and its component measurements was further demonstrated. Practical application of this means of increasing wool production was shown in a flock selected on the basis of the recommended characters. It produced a significant 4 per cent more clean wool than did the registered stud flock built up conventionally.

Dairy Cattle Production per Acre—Striking Increases

Work at Wollongbar Agricultural Research Station has demonstrated that a change in the calving time from the conventional July-August to December-January, supported by summer and winter legumes, may increase production per acre by as much as 60 per cent.

Expansion of Dairy Herd Recording

This year the ground work was laid for substantial expansion. Public Service Board approval was given this year for appointment of 13 additional Herd Recorders and two additional Relief Herd Recorders. During May and June, thirteen of the new officers commenced duty. Full impact of this additional work force will be apparent in 1964-65.

The Herd Recording Scheme exists to enable participating farmers to obtain reliable information on the performance of their animals, for programmed herd improvement.

The total of cows under "Official Herd Recording" increased this year from 10,630 to 11,300. The total under "Group Herd Recording" increased from 61,500 to 70,000.

Dairy Products Research

An additional dairy research officer was appointed, located at Hawkesbury Agricultural College. Development of a rapid method for determining the milk composition is proceeding. Butter and cheese qualities are under investigation. An officer has been seconded to the New South Wales Milk Board to study problems of trace metals and oxidation in milk.

Dairy Machines Research

A further appointment has been made, to expand research into the mastitis and milking machine efficiency/management complex; (also the solids-not-fat composition of milk.)

The milking machine survey is still revealing a high proportion of inefficient machines. Development of standards of performance for machine components and materials continued.

Another research field under attention is that of detergent and sanitiser efficiencies, with a view to formulation of standards.

Australian Plague Locust Outbreak

A very heavy outbreak of the locust *Chortoicetes terminifera* occurred in the central west, in the Dubbo, Canonba, Coonamble and Coonabarabran districts. These include the two main locust outbreak areas. Locust numbers were higher than for at least ten years.

A very intensive aerial spraying campaign was carried out in November and December. No significant swarm escaped from the area; nor was there a serious second locust generation in the southern section of the heavily infested area. Control measures had been especially concentrated there.

Argentine Ants Campaign

Excellent results were reported this year in a check survey of infestation areas sprayed in the eradication campaign since 1952. Of 156 separate infestations surveyed, total area 3,800 acres, involving 9,700 properties, 152 were found to be free from Argentine ants. The ants had been re-introduced to two of the other four infestations. The results are all the more significant inasmuch as 145 of the 156 infestations had been sprayed not less than five and up to twelve years ago. Any survivals in these would have had ample time to multiply, and would have been readily found during the survey.

Personnel and Staff Branch

Staff

Twelve New Agreements.—Twelve new Agreements affecting the salaries of Departmental officers were received, and the necessary adjustments of salaries were made.

164 *New Positions.*—Some indication of the expansion in the Department's activities is given by the fact that 164 new positions were created this year, as compared with 76 in the previous year. The details are as follows:—

	New Positions Created	
	1962-63	1963-64
Professional Division	24	50
Clerical Division	10	22
General Division	42	92
	76	164

The total number of officers employed under the authority of the Public Service Board, as distinct from Ministerial employees (853), increased from 2,163 at 30th June, 1963, to 2,384 at 30th June, 1964.

Staff Numbers at 30th June, 1964

	Public Service Board	Ministerial	Totals	Casuals included in Ministerial
Central Administration*	790	11	801	..
Division of Science Service	122	..	122	..
Division of Plant Industry	136	..	136	..
Division of Horticulture	131	..	131	..
Division of Dairying	165	..	165	..
Hawkesbury Agricultural College	149	81	230	..
Wagga Agricultural College	89	62	151	..
Experiment Farms and Stations	143	213	356	4
Division of Animal Industry—				
Head and District Offices	218	14	232	..
Meat Inspection Service	191	21	212	..
Queensland Border	62	1	63	1
Tick Quarantine Areas	54	448	502	8
Royal Botanic Gardens	134	2	136	2
Totals	2,384	853	3,237	

* Including Divisions of Information Services, and Marketing and Agricultural Economics.

Staff Changes and Movements

Retirements.—H. W. Eastwood, Chief, Division of Horticulture; R. H. Anderson, Director, Royal Botanic Gardens, and Chief Botanist, National Herbarium; E. J. Power, Pastures Protection Officer; S. L. Allman, Chief Entomologist; J. W. Preston, Second Clerk, Correspondence and Records Branch; G. M. Carse, Principal Livestock Officer (Pigs); M. J. E. Squire, Assistant Principal Agronomist; N. S. Shirlow, Principal Agronomist; V. H. M. Brann, Principal Livestock Officer (Poultry); C. A. Dickson, District Dairy Officer; C. M. Green, Overseer, Centennial Park; D. W. Harrison, Publicity Officer, North Coast Region; R. D. Price, Inspector-in-Charge, Copmanhurst; A. H. Potter, Inspector-in-Charge, Goondiwindi; J. F. Kevin, Inspector-in-Charge, Stanthorpe; and J. A. O'Reilly, Regional Supervisor, North Western Region.

Deaths.—J. C. Allsop, Meat Inspector; A. W. Standen, Meat Inspector; W. Wynnard, Inspector, Plant Diseases Act; V. C. Field, Rural Science trainee; G. J. Lloyd, Livestock Officer (Dairy Cattle); A. J. Clark, Stock Attendant; and A. V. Pettit, Ministerial Farm Hand.

Appointments/Promotions.—N. A. Steel, Principal Livestock Officer (Pigs); D. C. Duncan, Principal Livestock Officer (Poultry); B. O. French, Chief, Division of Horticulture; P. C. Hely, Chief Entomologist; H. K. C. Mair, Director, Royal Botanic Gardens, and Chief Botanist, National Herbarium; J. B. B. Owen, Pastures Protection Officer; A. B. Hermann, O. & M. Analyst; R. E. Jones, A.D.P. Systems Officer; J. J. Mannion, Senior Examiner, Accounts Branch; M. F. Napier, Senior Inspector of Accounts, Accounts Branch; G. Pasfield, Senior Entomologist; F. W. H. Cutting, Manager, Agricultural Research Station, Narrabri; and J. P. C. Smith, Manager, Poultry Research Station, Seven Hills.

Departed for Overseas.—See earlier section (P. 8) re overseas visit by the Director-General, Dr. Grahame Edgar; K. E. Hutton, Plant Pathologist, on 7th August, 1963, to be at East Malling Research Station, England, for 12 months from September, 1963, for fruit pathology work and to visit other research centres, in England and the Netherlands; D. E. Maccallum, Economics Research Officer, on 7th September, 1963, to accept a Research Assistantship in Agricultural Economics at the University of Illinois, U.S.A.; W. J. Greenhalgh, Fruit Officer (Research), Bathurst Agricultural Research Station, departed to the U.S.A. to take up a graduate Assistantship awarded by Cornell University; Dr. F. C. Butler, Principal, Wagga Agricultural College, on 26th May, 1964, to attend the 7th Commonwealth Mycological Conference on Plant Pathology at London in July, and to attend and present a paper at the Xth International Botanical Congress at Edinburgh, in August, 1964; also to visit Agricultural Colleges and Institutes in Great Britain; P. C. Hely, Chief Entomologist, 4th June, 1964, to attend the 12th International Congress of Entomology in London in July, 1964, and to visit citrus areas and investigators in South Africa, Israel, Florida and California, U.S.A.; N. K. Golding, Principal Veterinary Officer, on 21st June, 1964, to attend a special course on exotic and other diseases at Grosse Ile Experiment Station, Quebec, Canada, and to visit Research institutions in America, Canada, Great Britain and South Africa, returning to Sydney in August, 1964; R. C. Madsen, Regional Supervisor, Southern Region, and G. F. Donaldson, Economics Research Officer, Wagga, in November, 1964, visited New Zealand to observe the organisation and working of agricultural, farm management and allied advisory services.

Returned from Overseas.—A. C. Orman, Deputy Chief, Division of Plant Industry, resumed duty on 16th December, 1963, after a private trip overseas, during which he visited New Zealand to study seed production work of the New Zealand Department of Agriculture.

Botanist L. A. S. Johnson returned in mid-December after 15 months as Australian Liaison Botanical Officer at the Herbarium, Royal Botanic Gardens, Kew, England. Mr. Johnson also visited Botanic Gardens, Herbaria, and Universities in many centres in other parts of Britain, U.S.A., Canada, France, Belgium, Holland, Denmark, Sweden, U.S.S.R., Czechoslovakia, Austria and Singapore. In addition he attended congresses at Montreal and Aberystwyth and the International Genetical Congress at The Hague.

Botanist Dr. Barbara Briggs returned to the Herbarium in October after 15 months' leave abroad. She spent most of this period at the University of California at Berkeley, on a C.S.I.R.O. Overseas Post-graduate Studentship. Subsequently Dr. Briggs visited other Universities and Herbaria in America, also Herbaria, Universities and laboratories in England, continental Europe and the U.S.S.R. Dr. Briggs presented a paper at the XIth International Genetics Congress, Scheiveningen, Holland.

PERSONNEL WORK

Inductions.—Officers and employees taking up duty through Head Office were suitably inducted.

University and College Trainees.—The 44 new trainees of the Department as at the beginning of 1964, at the University of Sydney, the University of New South Wales and the University of New England, were provided with a ten-day Induction School at Sydney and Bathurst prior to commencing their University year.

Twelve traineeships tenable at Hawkesbury and Wagga Agricultural Colleges were also awarded at the beginning of 1964.

Currently there are 183 Department of Agriculture trainees at the various Universities and Agricultural Colleges; including 15 who are repeating an academic year at their own expense.

Supervision of trainees has been systematised such that they are being interviewed at prescribed times throughout the year; in part to maintain orderly contact and in part to ensure that the career wishes of graduating trainees may be known and taken into account ahead of their appointment on graduation.

Practical training of trainees has also been under review. Recommendations by a Departmental Committee appointed for this purpose will benefit the trainees during their courses and ultimately benefit the Department when the trainees are appointed to Departmental positions.

Tutorials for Public Service Board Examinees.—Classes were organised for Regulation 116 and Regulation 119 examination candidates. Field officers were advised in preparation for the Regulation 124 examinations. Study material was made available to all candidates.

Study Leave.—This was arranged for numerous officers for their part-time University or Technical College courses.

Counselling and Adjustment.—Advice and guidance were provided to a number of officers. Where appropriate the officer was referred to specialist officers at the Public Service Board.

First Aid Service.—This was continued at Head Office, and provision of first aid equipment for country institutions was supervised.

Career Inquiries.—Information concerning careers in agriculture was provided to career advisers, parents, students and interested organisations. Appropriate Departmental publications were supplied.

Colombo Plan and F.A.O. Fellows.—Facilities were organised within Head Office, country institutions and Regional headquarters for the Second Colombo Plan Public Administration Group, and for individual Fellows from Ghana, Thailand, Nigeria, Vietnam, Indonesia, Taiwan, India, Pakistan, Uruguay, Malaysia, Iran, Korea, Mexico, Philippines, North Borneo and Sarawak.

Legal and Registration Branch

ACTS PASSED

Wheat Industry Stabilisation Act, 1963.—The provisions of the previous Wheat Industry Stabilisation Act expired with the marketing of wheat harvested during the 1962-63 season.

This Act, 1963, repealed the previous Act and provided another stabilisation Act in substantially the same form.

Dried Fruits (Amendment) Act, 1964.—This Act increased the maximum sum a person in whose name a packing house is registered may be required to contribute annually to the New South Wales Dried Fruits Board. The increase is from 1/32nd to 1/16th of a penny per pound of the quantity of dried fruits sold from such packing house during the next preceding year.

Milk (Amendment) Act, 1964.—This Act amended the Milk Act, 1931-42 by discontinuing, except in specified circumstances, the provision under which dairymen vendors within areas under the Milk Board escape the vesting of their milk in the Board and are able to market their milk independently.

REGULATIONS, PROCLAMATIONS

There were 33 gazettals of Regulations, 40 Proclamations and 89 Notifications.

PROSECUTIONS

For offences under the various Acts administered by the Department 119 persons were prosecuted.

ARBITRATION: AGRICULTURAL HOLDINGS ACT, 1941

No matter was referred to arbitration under the Act. A decision is still awaited from a District Court Judge in respect of a stated case referred by a committee to the Judge two years ago.

REGISTRATIONS

Registrations effected during 1963-64 and 1962-63 are compared numerically in this tabulation:—

	1962-63	1963-64
Apiary registration	4,240	4,250
Potato licences	2,207	1,790
Stock foods	1,606	1,763
Stock medicines	1,660	1,581
Pest destroyers	1,829	1,870
Sheep brands	1,476	1,290
Sheep earmarks	1,659	1,549
Large stock brands	1,648	1,598
Fertilizers	633	704
Farm produce agents	294	293
Veterinary surgeons	474	503
Swine brands	942	804
Swine licences	131	55

Veterinary Surgeons Board

The Board met on 11 occasions.

The prescribed examination for veterinary graduates of overseas universities was held in September, 1963. Of the five candidates, one passed.

Stock Medicines Board

The Board met on 21 occasions. It registered 1,581 stock medicines.

Architect Branch

Funds Expended.—The amounts from Loan Funds, Consolidated Revenue Funds, Special Grants, and Unemployment Relief Vote expended on new work and maintenance work were as follows: Loan funds, £158,854; Consolidated Revenue funds (and including Western Division Public Watering Places), £151,700; Special Grants, £49,239, and Unemployment Relief Vote funds, £43,343.

Work Completed.—This comprised: at *Hawkesbury Agricultural College*—remodelling of the College laundry and installation of new equipment, completion of an agronomy shed, erection of a poultry laying cage house and a rearing shed, and extensions to dairy buildings; at *Wagga Agricultural College*—erection of a farm office, store, and two hay sheds, completion of a poultry slaughter house, the stables, horse boxes and soil testing shed, and extensions to the Graham Block; at *Bathurst Agricultural Research Station*—provision of improved office accommodation, toilet facilities, and entrance gates; at *Condobolin Agricultural Research Station*—completion of a grain shed; at *Dareton Horticultural Research Station*—improvements to domestic water supply, and erection of a steel stand and storage tank, a machinery shed, a cottage and a garage; at *Glen Innes Agricultural Research Station*—completion of a maize shed, improved toilet facilities and a septic tank; at *Shannon Vale Nutrition Station*—completion of sheep drafting yards, improved water reticulation, toilet facilities and a septic tank; at *Grafton Agricultural Research Station*—erection of a garage for farm vehicles, and bull sheds, improvements to office accommodation, and to water storage and reticulation, and provision of a library; at *Griffith Viticultural Research Station*—erection of a fruit packing shed, and a laboratory; at *Glenfield Veterinary Research Station*—erection of a machinery shed; at *Narara Horticultural Research Station*—erection of men's mess, and a glasshouse and improved toilet facilities; at *Narrabri Agricultural Research Station*—erection of a cottage, a grain shed and a glasshouse, and sinking of a bore to improve the Station's water supply; at *Orange Agricultural Research Station*—erection of a prefabricated steel building for store and offices, a machinery shed, a glasshouse and a cottage; at *Seven Hills Poultry Research Station*—erection of a poultry building, and enclosure of a cottage verandah; at *Tamworth Agricultural Research Station*—completion of a frost research glasshouse and a plant breeder shed, a machinery shed and extensions to the Manager's cottage; at *Temora Agricultural Research Station*—erection of a hay shed; at *Trangie Agricultural Research Station*—completion of an administration building, erection of a garage, beef cattle stalls, mechanics' workshop and fodder store, and improvements to drainage; at *Wollongbar Agricultural Research Station*—erection of pig farrowing pens, construction of an autopsy room and calf stalls, and water reticulation improvements; at *Wollongbar Cattle Tick Research Station*—completion of an office and laboratory building, and erection of cattle stalls; at *Yanco Agricultural Research Station*—completion of a fruit colouring room, erections of garages at two cottages, alterations to the North East, South West and North West dormitories, and provision of humidification in a glasshouse; at *Ashford*—erection of a cottage for the tobacco research officer.

Work Still Proceeding.—This comprises a cockerel shed at Wagga College; a machinery shed at Griffith Station; a grain shed at Leeton Station; a slaughter house at Wollongbar Station; the lecture and laboratory building, food preparation room, agronomy shed and wool classing building at Yanco Station; and the construction of a District Veterinary Diagnostics Laboratory at The University of New England, Armidale.

Maintenance Work.—Maintenance painting and repairs to cottages and/or farm buildings proceeded at the two Colleges and most of the Research Stations; also at the Queensland Border Control points. Desilting of tanks, construction of concrete storage tanks, erection of equipment and a considerable quantity of fencing proceeded at Public Watering Places in the Western Division.

Extension Service.—Numerous enquiries concerning rural building problems were attended to both by letter and personal interview. Plans representing farm buildings to the value of £291,960 were supplied to farmers.

Pastures Protection Section

RABBIT CONTROL

Training Schools and Field Days.—Schools Nos. 15 and 16, for the training of field officers of Pastures Protection Boards in up-to-date methods of rabbit control were held in the Denman-Singleton and Wagga Pastures Protection Districts, respectively. Emphasis was on the use of "1080" (sodium fluoroacetate) poison. School No. 16 was attended, also, by three officers of the Forestry Commission and one officer of the Water Conservation and Irrigation Commission.

A field day was conducted in conjunction with each school, to benefit the directors and staff of the Pastures Protection Boards of districts surrounding those where the schools were held. The field days were well attended. As many as 41 directors and officers from adjacent Boards attended at Wagga.

The beneficial results of these schools and field days, which have been conducted since 1958, are becoming apparent. The outlooks of Pastures Protection Boards and Rabbit Inspectors have changed. They in turn are successfully changing the attitudes of landholders in general to rabbit control, and especially with regard to use of "1080" poison.

Twenty-two Pastures Protection Boards now operate complete "1080" poisoning units, between them a total of forty units. Eight Boards have used aircraft for field assessment of rabbit infestations. Seven Boards have declared rabbit-free areas.

PLAGUE LOCUST CONTROL

A serious outbreak of Australian Plague Locust occurred in the Dubbo, Nyngan, Coonamble area in September, 1963. The peak was reached in November and December. Locust numbers were greater than in any outbreak since that of 1953-54.

During the campaign against this outbreak the spray materials comprised: 7 per cent BHC, 13,145 gal. and 15 per cent BHC, 6,966 gal. (£22,390); diesolene, 49,420 gal. (£6,600). Some £5,250 was expended on hire of aircraft for scouting and spraying. The campaign cost approximately £37,000.

Aerial spraying must be accepted as an efficient method of preventing the spread of plague locust, but would not always be necessary if landholders would treat the pests in the hopping stage, on the ground.

TRAVELLING STOCK RESERVES

As at 30th June, 1964, there were 348 Travelling Stock Reserves subject of applications but which Pastures Protection Boards have been unwilling to release from their control. These cases necessitate, in accordance with Ministerial policy, inspection by a field officer of the Pastures Protection Section. It was possible to inspect only 22 reserves during 1963-64; because the field officer in the establishment to carry out this work resigned in December, 1963.

STAFF STATISTICS—PASTURES PROTECTION BOARDS

During the 12 months the number of veterinary inspectors employed by Pastures Protection Boards increased from 29 to 33; the total of secretaries remained 59; the rangers' total increased by one, to 63; and the rabbit inspectors decreased by one, to 66.

Biometrical Branch

General.—The staff of this Branch advise other research workers in the Department on design, analysis, and interpretation of experiments, and on sampling and survey methods and related problems. At commencement of an investigation the biometrician helps to clarify and define objectives, to select the precise questions to which answers are to be sought, and to decide the exact plans and procedure to be followed. On completion of the experimental work, he is available to make mathematical-statistical analyses of the data and advise on interpretation. Almost all investigational work benefits from biometrical assistance at some stage.

Advice was given during the year on a wide variety of projects. On the design side the advice concerned such matters as fertilizer rates of application in experiments with pastures and field crops; sampling methods for soils, fruits, animals, and pastures; ancillary measurements for covariance adjustments, selection of sites and size and arrangement of plots in the field, and experimental designs proper. The volume of consulting work on design of experiments, and of computing work in analysis of results, each increased steeply. The increases were in line with recent increases in research establishment throughout the Department.

Punch Card Section.—Programming for data-processing of Dairy Herd Recording records on the Public Service Board's Honeywell computor commenced in March, 1963, and has continued. Eventually the Punch Card Section of Biometrical Branch will be responsible only for the punching and verifying of cards for input to the computor, and the A.D.P. Centre will process the records and print all tables and summaries. At end of year the Punch Card Section is still responsible for the stages of data-processing up to production of completed lactation cards and including production of lactation statements for Official Recording.

RESEARCH STATIONS BRANCH

Technical subject matter work of the Department's Research Stations is covered in the reports of the Divisions of Plant Industry, Animal Industry, Horticulture, Dairying, and Science Services, the Hawkesbury and Wagga Agricultural Colleges and the Agricultural Research Institute, Wagga.

The Research Stations Branch, formerly known as "Experiment Farms and Stations Branch", is responsible for developmental and operational administration of:—

- nineteen Research Stations;
- the Farms at Hawkesbury and Wagga Agricultural Colleges and Glenfield Veterinary Research Station;
- plant and machinery for Division of Plant Industry projects at Berry and Graman, and those needs of the Royal Botanic Gardens, Sydney, Agricultural Research Institute, Wagga, and the Division of Science Services, Rydalmere;
- a Farm Mechanisation Advisory Service;
- a limited agricultural machinery research programme.

Developmental Aspects

Major developmental activities were as follows:—

RESEARCH STATIONS

Tropical Fruit Research Station, Alstonville.—The completion and fitting of a modern packing shed, including electrical extension, ended the first stage of development of this Station to a completely operative unit. Provision of water storage for irrigation research is being examined now.

Agricultural Research Station, Condobolin.—Plant and equipment were supplied to initiate large scale cereal nutrition and plant improvement research in the central western wheat belt. The work is to be based on this Station.

Agricultural Research Station, Cowra.—Expanding pasture improvement and sheep management research on this Station called for provision of materials for considerable subdivision. A new grain shed was also erected for the cereal pure seed programme.

Horticultural Research Station, Dareton.—The expanding research programme called for expansion of irrigation facilities. Grading and packing equipment was installed in the new packing shed. A manager's residence was also erected.

Agricultural Research Station, Glen Innes.—Extensive subdivision was done on this Station, for the beef cattle research.

Shannon Vale Nutrition Station.—Re-development of Shannon Vale Nutrition Station by extensive sub-division, expansion and reticulation of water supply, and additional buildings, was completed; to extend the research programme in pasture improvement, and livestock production. Arrangements were completed also for extension of electricity to the Station.

Agricultural Research Station, Grafton.—Plant and equipment were provided to expand research activities into adjacent districts, for beef cattle nutrition studies.

Viticultural Research Station, Griffith.—Another machinery shed, a new packing shed, and alterations to existing buildings to provide a laboratory, have almost completed the major re-development of the Viticultural Research Station, Griffith.

Horticultural Research Station, Narara.—Office facilities were modernised and a glasshouse was erected for improvement of research work.

Agricultural Research Station, Narrabri.—A glasshouse and a grain shed were erected for research, and additional irrigation equipment was installed.

Agricultural Research Station, Orange.—A glasshouse and shed-office were completed and a machinery shed and cottage are under erection. Electricity was extended and arrangements made for water supply. Additional clearing allowed for increase in potato seed and insect control work. This new Station is to centralise potato work now scattered over the central tablelands, and to produce "elite" potato seed. Later it will be used for other work including fruit research.

Agricultural Research Station, Tamworth.—Additional buildings were erected in further development of the research centre. Provision also was made for improved facilities for transport of plant in the Station's work which extends throughout the northern wheat belt.

Agricultural Research Station, Temora.—A hay shed was erected.

Agricultural Research Station, Trangie.—Additional buildings and yards were provided for extension of beef cattle research, and a large mechanical workshop was erected. The water reticulation scheme was augmented.

Agricultural Research Station, Wollongbar.—At Wollongbar, more buildings were provided to expand animal research, principally with pigs.

Agricultural Research Station, Yanco.—Expansion of the Farm Certificate Course at the Agricultural Research Station, Yanco, called for provision of substantial capital improvement there. New buildings commenced this year included a new lecture block, a building for wool classing demonstrations and a new grain shed. Major work was also done to modernise existing dormitories. Water supply was also improved.

Increase in cotton research on this Station required the supply of considerable equipment.

Operational

The Branch was responsible for the expenditure of £60,222 (not including farm labour cost) in maintenance, upkeep, extension and renovation of buildings, water supply, fences, roads, erosion control structures, etc., at Research Stations.

Buildings.—Building maintenance, repair and improvement activities were considerable. Some work of this nature was done at all Research Stations. The Architect's report details major work, which was supervised by that Branch, but many minor repairs and a lot of maintenance work were done by Station employees.

Total expenditure in maintenance and extension of buildings and water supply was approximately £52,870.

Fences.—£7,350 was allocated for fencing maintenance and additions. The major jobs were at Bathurst, Condobolin, Glen Innes, Grafton, Seven Hills, Shannon Vale, Temora, Trangie, Wollongbar and Yanco. In some instances, Shannon Vale and Glen Innes in particular, Industry Research Funds were used for this work.

Roads.—Road repairs at all Research Stations are routine operations. Some major works included tar sealing of the entrance drives at Condobolin, Grafton, Griffith, Narrabri, Temora and Yanco. At Trangie and Dareton the drives were re-sealed. Arrangements have been made for sealing at Cowra. Kerbing and guttering, in addition to sealing, were done at Seven Hills. At Grafton, Wollongbar, Alstonville, Yanco and Leeton, considerable gravelling was done.

Aesthetic Surrounds.—Aesthetic appearance of these Stations is a responsibility of the Managers, as is provision of wind brakes and shade. Substantial work was done, particularly at Condobolin, Leeton, Temora and Cowra. Plans were made and partly effected for beautification of the surrounds of the administration area at Tamworth and Grafton. At Trangie, surrounds of the new Administration Building were kerbed and lawns were laid.

Soil Fertility.—Maintenance of soil fertility is another of the Manager's responsibilities. Planning and use of proper crop rotations, including pasture phases and green manuring in orchards, were the main actions.

Property Security.—This spring was a further season of heavy pasture growth in western districts, followed by fire hazard and constant attention to fire control measures. Flooding on the north and central coasts caused damage, requiring particular attention.

General Maintenance.—General farm maintenance included maintenance and construction of erosion control structures, and preparation of land for irrigation and drainage.

Irrigation.—Irrigation required an annual maintenance programme. But, in addition, installation of a new irrigation plant at Narrabri and a like installation at Dareton were completed. At Glen Innes, an irrigation system was installed on the maize breeding sub-station at Waterloo.

Fodder Production.—Prolific crops were harvested on cereal producing stations in 1963, and fodder reserves greatly increased. At 31st May, 1964, the total fodder stored on exporting Stations was approximately 46,000 bushels of grain and 1,800 tons of hay. These reserves, greater than at 31st May, 1963, were in spite of the necessity for hand feeding of stock in the late autumn and early winter of 1964. They are sufficient to meet the immediate needs and to feed stock for a lengthy period of drought conditions. The estimated value of the fodder in reserve is £60,000.

Some Research Stations produced fodder in excess of domestic requirements. This was transferred to other establishments where the type of fodder could not be produced. Some £16,000 worth was so transferred as grain and hay.

Seed Production.—Most Research Stations engaged in seed production and were virtually self-sufficient. About 1,100 bushels was transferred from cereal producing Stations to others. Condobolin Station produced 300 lb. of Barrel Medic seed surplus to domestic requirements, transferred to other Stations.

Livestock.—Considerable interchange of livestock occurred between Departmental institutions. By this means excess production at some establishments was used to reduce expenditure which would otherwise have been incurred by deficiency of resources at others.

Farm Machinery.—About £36,600 was spent on provision of plant, not including expenditures from Industry Research funds.

The Branch acted in a recommending capacity for the purchase of plant at Wagga and Hawkesbury Agricultural Colleges and Glenfield Veterinary Research Station. Similar action was taken relating to items of plant purchased from Plant Industry Division funds and Industry Research Funds—the Wheat Industry Research, Wool Industry Research, Tobacco Research, Dairy Industry Research, and so on, when requested by the Chiefs of the appropriate Divisions. This was so also in the purchase of plant for Wagga Agricultural Research Insitute, the Cattle Tick Research Station, and the Royal Botanic Gardens.

The Branch gave advice to numerous Departments and instrumentalities regarding rural mechanisation, agricultural machinery and plant and allied subjects, and also assisted in selection of staff and personnel for some of them.

Contact with the Tractor Testing Station, Victoria, was retained. The Standards Association was given assistance in its deliberations on horse power ratings in internal combustion engines, and an F.A.O. representative was advised of recent developments in land clearing methods. The Department cf Agriculture of Western Australia obtained data regarding clover thrashing machines and auto strippers. The British and Danish Trade Commissions have regularly contacted the Branch regarding market prospects and suitability of machinery manufactured in these countries for Australian conditions. Information and advice was given on rural mechanisation and agricultural machinery to Colombo Plan students.

Motor Vehicles.—An important factor in the conduct of Research Stations is the supply and maintenance of transport. It is a responsibility of the Research Stations Branch to recommend replacement of old vehicles on Research Stations and to take delivery of all new vehicles supplied to the Department in order that they may be completely checked upon delivery.

Plant Inspectors of the Branch inspected all Departmental vehicles attached to Head Office to determine any necessary repairs; inspected vehicles after repair work and provided clearances.

Stores and Minor Equipment.—Timely supply of stores and items of minor equipment was supervised. Total value of stores supplied, including repairs, was approximately £70,000.

Labour.—The Branch supervised the allocation of labour, regular and casual, for efficient conduct of Research Stations. The number of Field Assistants located at these Stations and responsible to the Chief of the Branch increased. They now total 96, with other appointments pending.

Research

The Branch does not engage to any extent in research, but tests agricultural machinery supplied from funds provided by the Commonwealth Agricultural Machinery Research Vote and Commonwealth Agricultural Extension Grant Funds. This work continued on a limited basis.

It is increasingly evident, however, that research in the field of agricultural machinery is essential, in order that the Farm Mechanisation Advisory officers may be properly informed and provide the greatest benefit to the rural industry. To this end, action has been taken to seek approval for appointment of a Research Engineer to be engaged wholly on agricultural machinery research.

Advisory Service on Farm Mechanisation

Field Advisers.—Development of the Service progressed. Demand for the services of Agricultural Machinery Officers continued to increase. A further officer was appointed, located in the Southern Agricultural Region at Wagga.

Agricultural Machinery Officers are now located in the South Western Region (headquarters Leeton), the Western Region (headquarters Orange) and the Southern Region (headquarters Wagga Wagga). The duties of these officers are to advise landholders in the use, servicing, maintenance and the repair costs of agricultural machinery. Advice is also given on the purchasing and replacement of suitable farm plant, having regard to the economic potentialities of the holding.

A fourth Agricultural Machinery Officer is attached to Yanco Agricultural Research Station, lecturing to students taking the Farm Certificate Course. The Agricultural Engineer is responsible for his activities.

The Agricultural Engineer and Extension Services.—The Agricultural Engineer devoted a lot of time to keeping the Agricultural Machinery Officers in the field posted with information, and on in-service training activities.

He also tendered advice to rural inquirers by correspondence, telephone and personal discussion, and engaged in other extension work.

He published eight articles in the New South Wales Agricultural Gazette, and two Department of Agriculture booklets. He issued 39 news items, made eight radio and two television broadcasts, wrote nine articles for extension journals and field day programmes, and attended eight machinery field days.

He adjudicated at the Junior Farmers State Championship for Tractor Maintenance and Operation Projects, and attended 31 meetings and agricultural conferences.

Safety in Agriculture.—The Agricultural Engineer has been appointed to the Advisory Committee for Safety in Rural Industries set up by the Minister for Labour and Industry, and to another Inter-Departmental Committee on Occupational Safety set up by the Public Service Board.

Standardisation of Agricultural Machines.—The Agricultural Engineer provided advice to the Standards Association of Australia on the standardisation of agricultural machinery, and is on the committee drawing up a new standard for the rating of horsepower in internal combustion engines.

Schools in Agricultural Engineering.—In association with the Agricultural Engineering Society, a three-day residential school was organised at Hawkesbury Agricultural College for members of the machinery trade—on "water use" and "production of wheat and wool". About 40 attended full time, and there were up to 70 in attendance at some of the day sessions.

Three short schools were organised in the Southern Region on "diesel tractor maintenance". These were attended by about 100 landholders.

The schools were conducted in an effort to decentralise the Department's Tractor Maintenance Schools formerly held annually at Hawkesbury Agricultural College but now scheduled to take place at two-year intervals.

Agricultural Machinery Officer, South-western Region.—This officer had very heavy demands on his services and is finding it increasingly difficult to handle personal inquiries which are now coming to him from distant parts of the Region.

He initiated the organisation of the first large scale agricultural machinery field day for the Murrumbidgee Irrigation Area. It was attended by 2,500 people; over 40 exhibitors took part and 135 separate field day demonstrations were given.

He also was responsible for formation of an Agricultural Engineering Society which brings together members of the various Governmental research and extension offices, members of the machinery trade and the local farmers, to discuss district problems in agricultural engineering.

Mass media extension work in this Region is done mainly by radio. The officer conducts two regular sessions each week, and last year made a total of 110 radio broadcasts.

Close liaison has been maintained with machinery dealers in the various towns and this provided a two-way channel for exchange of information and guidance on machinery matters both for the farmer and the machinery dealer.

A number of small schools and field days were held for landholders throughout the Region and some meetings of the Agricultural Bureau were addressed.

During the year 262 farm visits were made, to handle a wide variety of inquiries concerned with tractors, stationary engines, electric motors, tillage equipment, combine and seed drills, cotton machinery, rice and wheat headers, fodder conservation machinery, vegetable and orchard machinery, bulk handling equipment for rice and cotton, fruit dehydration machinery, weed control, irrigation machinery, graders, levellers, delvers and workshops.

Considerable effort was made to assist farmers to set up and run their own workshops. A pamphlet was produced on "Farm Machinery Maintenance". This was distributed throughout the Region. As a direct result of this work, landholders are becoming more maintenance conscious and are finding a resulting reduction in their repair bills.

A telescopic orchard spray tower has been designed for farmers who have trees of varying heights on their property. This has proved successful and it is expected that many will be made in the Region during the year. A hydraulic delver, designed last year, is now in commercial production.

Agricultural Machinery Officer, Western Region.—The work in this Region has expanded considerably and the number of inquiries received was a big increase on last year's. Inquiries were received and advice was given to landholders on a large variety of subjects, including tractors, equipment and designs for cool stores and shearing sheds, cultivation machinery, drills and combines, grain drying and cleaning machinery, harvest and cleaning grass seeds, fodder conservation machinery and food lot systems, implements and mechanical aids for livestock husbandry, orchard machinery, bulk handling of potatoes, pipe lines and stock drinking troughs, pumps, earth dams and bore screens, sprinkler irrigation equipment, farm roads and fencing equipment, farm workshop design and equipment for workshops.

In addition, this officer visited 225 landholders throughout the Region. Constant liaison was maintained with machinery agents throughout the Region, and information was exchanged on a wide variety of topics; 50 visits were made to machinery agents and dealers.

Use was made of the press; 19 press statements were issued, used in district newspapers; three articles were prepared and used in field-day programmes; feature articles on the Orange National Field Days were prepared and used in special editions of three of the big city-based rural newspapers.

Three television sessions were given and tapes were supplied for 125 radio sessions; eight radio talks were also forwarded for use in other Regions.

The officer also attended 12 meetings of the permanent Organisation Committee of the Orange National Field Day, and participated in a further 12 smaller field days and meetings of landholders' organisations. He gave addresses at five short schools.

Agricultural Machinery Officer, Southern Region.—This officer has only recently taken up duty, but it is already evident that his service will be much sought after.

DIVISION OF PLANT INDUSTRY

General

Extension Staff Situation.—Extension staff losses are a major problem. Approval has been given to increase the agronomy staff by nine, but, during the year, seven District agronomists resigned and one was seconded to the position of Manager, Narrabri Agricultural Research Station whilst another was granted a year's study leave to attend the University of Queensland Diploma of Extension Education Course.

Also, Assistant Principal Agronomist (Extension), Mr. M. J. E. Squire, retired after 44 years service.

Of the seven District agronomists who resigned, three are now associated with private Rural Advisory Groups or in private practice, one is a rural valuer with the Commonwealth Development Bank, one has joined the Australian Broadcasting Commission's staff, one has gone to a commercial vegetable oils organisation and another is at the University of New England.

Of the thirty-seven established agronomist Districts, seven are vacant: Armidale, Cootamundra, Deniliquin, Junee, Parkes, Tumut and Wentworth. For various reasons, staff changes or vacancies occurred in 17 districts (46 per cent) this year.

On the other hand, three Districts that had been vacant were filled: Bathurst, vacant 5 years; Goulburn, vacant 16 months; and Queanbeyan, vacant 2¼ years.

In-service Development of Agronomists for Extension.—A plan of in-service experience and training for agronomists to fit them for subsequent District duties was inaugurated early in 1963; diplomate agronomists, after initial technical experience at Research Stations for about two years are transferred to appropriate Regional extension headquarters. Whilst attached to the Region they absorb training and experience in extension and administrative work—so that they might qualify in due course for District agronomist status. They are given the opportunity to work not only with the Regional Supervisor and District agronomists but all other categories of extension worker operating in the Region. Wide knowledge of agriculture and the associated problems is gained by the "trainee".

This year three agronomists completed this area of training and were appointed as District agronomists, viz., to Bathurst, Leeton and Queanbeyan. Five agronomists are at present participating in this in-service training within Agricultural Regions.

District Agronomists' In-Service Training.—Facilities for District agronomists to keep abreast of technical agricultural developments and extension methodology were provided in special schools, conferences and field days—in various parts of the State and, in some cases, inter-State.

Extension Activities.—Despite limited number, District agronomists maintained close contact and good relations with their public. Demand for specialised agronomic advice continues to increase. Even under the most favourable circumstances in terms of staff numbers the Department would be unable to provide a personal service to all farmers seeking advice. Mass and group channels of extension service have accordingly been used comprehensively, including press articles, radio talks, field days, meetings, schools, conferences and, of recent times, television.

During the year 28 District agronomists aggregated: 221 field days, with attendances of 10,160; 195 meetings, with attendances of 3,831; 492 broadcasts, some television segments, and 460 press releases.

Also each District agronomist prepared monthly a report on seasonal prospects and production trends. The information contained was eagerly sought by financial institutions, many public and private organisations, and extracts were freely used by both the metropolitan and provincial press.

Experimental plots and demonstration areas comprise an important facet of District agronomists' extension work; with crops and pastures on private farms. The agronomists also supervise seed production areas in the Department's pure seed programmes, collaborative with co-operating farmers.

Experiment, demonstration, and seed production areas conducted in co-operation with farmers on their properties this year totalled as follows:—

Crops:

	Projects
Wheat	96
Oats	46
Barley	14
Maize	34
Sorghum	14
Cotton	16
Rice	14
Oil Crops	16
Vegetables	35
Miscellaneous	27

Pastures:

	Projects
U.P.S.E.T. trials	450
Miscellaneous	124
A.E.G. demonstrations	25
D.I.E.G. demonstrations	72

Registered Seed Areas:

	Production areas
Wheat	127
Oats	96
Barley	23
Rice	52

Advisory Groups.—The growing demand by farmers and pastoralists for a more personal and specialised advisory service has in recent years reached expression as "Farm Advisory Groups".

A "group" or "club" is a corporate organisation, typically of 30 to 40 farmers living within a radius of 10 to 20 miles of a centre. The group employs a Farm Adviser, required to provide personal service to members. Annual cost of operation is £3,500 to £4,500. One of the major problems confronting the organisers is shortage of trained Advisers.

The number of Rural Advisory Groups increased during the year to twenty-six. In addition, seven more groups are in process of formation or awaiting opportuniy to select and appoint an Adviser.

Group Advisers liaise with and seek technical matter from the Department, amongst other sources. These are desirable relationships.

Research Staff and New Activities.—Four graduates were recruited and five resigned. In addition the Principal Agronomist (Research), Mr. N. S. Shirlow, retired on 25th May, 1964. Overall, total research staff was depleted by two.

New programmes of research were commenced, as follows:—

(*a*) Wheat Nutrition Research in the Central West: This is a co-operative project with Division of Science Services Chemistry Branch. It is financed from Wheat Industry Research Funds. The agronomist concerned is located at Condobolin Agricultural Research Station. From there he travels to co-operating farmers' properties in surrounding districts.

(*b*) Pasture Research at Cowra Agricultural Research Station: The agronomist concerned is initially confining his project to the Research Station.

(*c*) Pasture Research on the Southern Tablelands: This programme is financed from Wool Industry Research Funds. The agronomist carrying it out is located at Canberra. The C.S.I.R.O. Division of Plant Industry has provided him with office accommodation and other facilities at the Black Mountain offices.

(*d*) Weeds Research at Yanco Agricultural Research Station: The agronomist working on this programme aims to find control methods for various weeds troubling farmers in the Murrumbidgee Irrigation Area.

Plant Introductions and Exchanges

Some 666 plant introductions were made, and 369 samples of seed were sent to overseas research workers.

Land Settlement Services

The Department's co-operation with Closer Settlement Advisory Boards in selection and design of estates for closer settlement was co-ordinated by the Principal Agronomist (Extension). This officer also made the final inspection of Estates with Board members. District agronomists, and other extension officers when needed, participated in inspection of Estates, preparation of topographical surveys, and farm design.

Prevailing high land values and less funds for closer settlement restricted the total of Estates acquired this year. On the other hand there was no shortage of applicants for land despite high capital value for closer settlement leases and consequent higher rents.

The year's work for and with the Closer Settlement Advisory Boards comprised: Inspection of six Estates by the Principal Agronomist (Extension) in company with Board members; conferences with Board members relative to Home Maintenance Areas, sub-division of Estates, and farm design; and District agronomists' inspections of 27 Estates. The latter included preliminary inspections and submission of type "A" reports; joint inspections with Lands Department officers, and topographical surveys and farm design work with the District surveyor or his representative.

Total area involved was 183,631 acres.

Irrigation

Committees.—With Burrendong Dam nearing completion the N.S.W. Water Conservation and Irrigation Commission has re-appointed a committee to re-examine recommendations for Macquarie Valley irrigation development, particularly in view of possible increased private pumping and such new crops as cotton. The Chief of the Division of Plant Industry and the Special Agronomist (Irrigation) are members of the committee.

The same committee will examine likely Gwydir Valley irrigation development should proposed construction of a major dam on the Gwydir River eventuate.

A committee which had been appointed to examine the potential for group irrigation in the Lower Darling area, particularly for dairying and horticulture near Menindee, submitted its report during the year.

The Australian Standards Association Drafting Sub-committee on Spray Irrigation has submitted a Draft Code for publication and public review. The Code represents a major forward step for spray irrigation design and performance.

The Special Agronomist (Irrigation) is a member of committees as follows and this year has attended the number of meetings indicated by the respective figure: Hunter Valley Conservation Trust (Department of Conservation), 19; Standards Association—Spray Irrigation Committee, 6; Water Research Foundation, 5; Blowering Dam Investigations (Water Conservation and Irrigation Commission), 1; Lower Darling Resources Committee (Premier's Department), 3; Yanco Station Certificate Course, 2; Soil Survey and Tullakool Irrigation Area, 3; and Gwydir River—Irrigation Proposals, 1; a total of 40 committee meetings affecting irrigation.

Farm Enquiries.—Farmer's requests for advice have been continuous throughout the year, on such matters as irrigation development and management, means of augmenting water supplies in pasture improved areas where property water conservation has in some cases caused insufficient run-off for stock watering, sealing of dams to prevent leakage, and drainage of farm lands and market gardens, etc.

Liaison with Commerce.—Liaison has been sustained with firms supplying irrigation equipment, fertilizer injectors, etc., and two advertising firms on national advertising assignments connected with irrigation have been advised.

Farm Water Supplies Act, Assistance Applications.—Under the Farm Water Supplies Act, 1946, applications by landholders for advances to purchase and install irrigation facilities costing in excess of £1,000 have been referred by the Water Conservation and Irrigation Commission to the Department of Agriculture for examination. Twenty-six from the previous year and 57 new cases were dealt with this year.

Coleambally Developments.—The Griffith District agronomist has continued to work closely with the Water Conservation and Irrigation Commission in respect to design of farms in the Coleambally Area and their development into economic irrigation units. Value of production from Coleambally last year has been estimated at £615,000; 5,364 acres were sown to rice, on 89 farms, and yielded 14,685 tons (yield average 2.74 tons per acre).

Weeds

CO-OPERATION WITH OTHER ORGANISATIONS

With Other Departments and Local Government.—Close liaison has been maintained with the Department of Local Government in administration of noxious plants legislation. On a recommendation from Division of Plant Industry approved by the Minister for Agriculture, the increased grant of £100,000 was made available to Councils by Department of Local Government as follows: to eight County Councils, £37,350; to 80 Shires, £57,900; and to 14 Municipalities, £4,750.

The increased funds led to more effective and co-ordinated control of Noogoora burr (*Xanthium pungens*) in the Riverina; and there was increased activity on serrated tussock (*Nasella trichotoma*), groundsel bush (*Baccharis halimifolia*), and skeleton weed (*Chondrilla juncea*) among others. Closer contact with most Shires has been established by delegation of certain aspects of responsibility to Regional Supervisors of Agriculture in recommendations of grants.

Contact has also been maintained with other Departments, particularly Railways and Forestry, though limited by staff shortages.

The Noxious Plants Investigation Committee.—This Committee, set up during the previous year to investigate and report on administration of control and eradication of noxious plants within the framework of Local Government, presented a majority report to the Ministers for Local Government and Agriculture on 15th May, 1964. The Committee's recommendations envisaged an integrated development based on education, regulation, co-ordination and finance. Advice has been received that the report has been adopted in principle.

Councils' Weeds Officers School.—A two-day school for weeds officers of Councils in Southern Agriculture Region, held at Wagga, was attended by representatives of most Councils in the area and of other Government bodies concerned with weeds.

Co-operation with Herbicide Manufacturers.—Liaison was maintained with herbicide manufacturers and importers; in discussions on research, advisory and marketing problems. The Weeds Research Officer located at Hawkesbury Agricultural College by Geigy (Aust.) Pty. Ltd. continued a research programme of high standard in close co-operation with Division of Plant Industry. This satisfactory working arrangement continued to benefit the Department, particularly in the continued absence of a Departmental weeds research agronomist at that centre.

SERRATED TUSSOCK CONTROL

New serrated tussock (*Nasella trichotoma*) infestations were discovered in the south, as had been predicted, in Mumbulla and Bibbenluke Shires. Continued publicity given to this weed has brought to light other new infestations in other Shires on the margins of the main infestations. There has been increased activity by many Councils regarding serrated tussock, but lack of interest in several lightly infested areas is of serious concern.

Aerial Techniques.—Trials over the last three years have shown that serrated tussock can be killed by aerial application of 2,2-DPA in most non-arable areas. The Piper Pawnee has been found a most suitable aircraft, able to apply 2,2-DPA in 8 gallons of water per acre. Best conditions for spraying occur soon after dawn when wind and evaporation are low. Serrated tussock has been killed efficiently from the air with 20, 25 and 30 lb. of 2,2-DPA per acre and promising results have been obtained with 10 and 15 lb. per acre.

Aircraft have subsequently achieved improved pasture species coverage of the sprayed areas by applying seed and superphosphate in runs 11 yards apart instead of the normal 22 yards.

The serrated tussock control on non-arable areas by the use of aircraft to spray the tussock and, in the following winter, sow pasture species, was well demonstrated at major field days held at Rockley and Porter's Retreat during November, 1963. The field days presented a remarkable demonstration of the high percentage of serrated tussock kill, effective replacement by vigorous pasture mixtures, and that serrated tussock can be replaced by productive pastures over large areas of non-arable land at reasonable cost. Further to the demonstration, 582 acres were sprayed commercially by twelve landholders and the Forestry Commission.

Aerial Spraying by Landholders.—The twelve landholders who this year used aerial spraying did so on 426 acres, under the guidance of the Department. Last year seven landholders sprayed 225 acres. The Forestry Commission sprayed another 156 acres with low rates of 2,2-DPA (burnt one month later) prior to planting pine trees. The Department of Agriculture sprayed 184 acres in experimental work. Thus a total of 766 acres was aerially sprayed during the year.

Spot Spraying.—Landholders have readily accepted spot spraying as a means to kill isolated tussock outbreaks; 7,145 lb. of 2,2-DPA was used in 1963 spot spraying on the central tablelands, and over 4,000 lb. was used in the first four months of 1964. Several tons were also used on the southern tablelands during the year.

Chipping Gang.—A gang of three men, employed by Upper Macquarie County Council for chipping and spot spraying tussock, treated 9,630 acres of land infested with scattered tussock from August, 1963, to May, 1964; including 7,480 acres on private holdings and 2,150 acres on crown lands.

"Time of Oversowing" Trials.—Good establishment of pasture species on unploughed ground was achieved by sowing from April to September in 1963, a wetter year than normal. Results achieved by an aerial sowing on 1st June, 1963, on 127 acres of sprayed tussock on non-arable land were: red clover 18.8 per cent establishment; white clover 7.2 per cent; subterranean clover 16.5 per cent; perennial rye grass 20.4 per cent; cocksfoot 15.8 per cent; and *Phalaris tuberosa* 3.6 per cent.

Control of Seeding in Tussock.—Five rates of 2,2-DPA ranging from 5 to 20 lb. per acre prevented serrated tussock from seeding when applied in early and mid-October. The chemical had little effect on seeding when applied in mid-November, December and January.

Extension Education on Tussock Control.—An indication of the emphasis given to this plant in extension work is that the agronomist at Bathurst Agricultural Research Station concerned with serrated tussock research was associated with fifteen field days, addressed sixteen public meetings, made three television appearances and was associated with a special exhibit on serrated tussock at the Armidale Centenary Show Other meetings for the purpose were also attended by other Departmental officers.

HERBICIDE RESEARCH

At Yanco Agricultural Research Station, investigations have been initiated with a wide range of herbicides and herbicide mixtures—into the control of various weeds of irrigation and drainage channels.

At Hawkesbury Agricultural College herbicides were tested for control of weeds in peas, carrots, parsnips, celery, various summer and winter cereals and summer pasture legumes. In maize, weed control with ametryne, atrazine and propazine was better than with linuron or CDAA-T. In broom millet, atrazine at 4 lb. a.i. per acre applied shortly after emergence of the crop gave best results. A wide range of summer pasture legumes was subjected to a number of herbicide treatments. The most promising weed control without crop damage in the pre-emergence trials was by trifluralin at 2 lb. per acre or CDAA at 4 lb. per acre.

Much research was done under field and glasshouse conditions, for the bio-assay of herbicide residues in the soils. Crimson clover and oats were particularly good test plants.

At Narrabri, preliminary work on chemical weed control in cotton indicated trifluralin, prometryne and diuron as the most promising herbicides.

SPECIFIC WEED PROBLEMS

St. John's Wort.—St. John's wort (*Hypericum perforatum*) remains a major problem in many high rainfall areas. One of the worst areas has been near Mudgee, where past emphasis has been on biological and herbicidal control. This year the mid-Western County Council has been instrumental in clearing many roads and Crown lands, helped by the available additional funds.

Control by competing pastures has not been adequate in the past. By use of struggling strains of clovers on a pasture base, one farmer in the district has controlled St. John's Wort to a point where the pastures were safe for sheep after a lapse of about ten years.

By applying recent developments in use of white clover the lapse period has been shortened to four years, in a demonstration area; while application of the more recent discovery that Marrar subterranean clover was particularly adapted to the district has indicated that effective control of St. John's wort with full grazing by white faced sheep may be had in two or three years.

The full application of these findings could rapidly improve the St. John's wort position in the area, reduce costs of control and increase carrying capacity of the land.

One property in the nearby Bylong area has already been developed along these lines. Over 1,000 tons of superphosphate, together with Marrar subterranean clover, Ladino white clover, lucerne and ryegrasses have been spread over 7,000 acres.

Groundsel Bush.—Groundsel bush (*Baccharis halimfolia*) is the most serious weed of the far north coast and is spreading rapidly despite a campaign to control it. Research has shown that groundsel bush is readily controlled by spraying with 2,4-D at a strength of 0.2 per cent active ingredient, provided treatment is thorough and allowance is made for less efficiency of the sprays in autumn and winter.

The free seeding habit of groundsel bush means that control can only be achieved by an intensive co-ordinated effort throughout the area involved. Queensland experience is that the seed does not persist in the soil beyond three to four years, so an intensive programme should bring this weed under control.

Skeleton Weed.—Skeleton weed (*Chondrilla juncea*) continued rapid spread in northern parts of the wheat belt. It is causing much concern there in the absence of a suitable competing pasture. This year infestations which have obviously been in the Inverell district for some years have been discovered.

An intensive programme of control has been developed by local government authorities in the Gunnedah-Tamworth district, aiming to eradicate the weed in the area. Though eradication might not be possible the infestations can be greatly reduced and restricted.

Yellow Poverty Weed.—This weed (*Calocephalus sonderi*), a native annual, caused concern in the Urana area. The heads tainted some 60,000 bushels of wheat. Though rarely a trouble, the plant was this year favoured by abnormally high autumn and winter rainfall.

Weed Control in Wheat.—The proportion of the wheat crop herbicidally treated for weed control has increased. This season 50 per cent of the crop in some districts was sprayed with 2,4-D primarily for control of skeleton weed and saffron thistle (*Carthamus lanatus*). Concern at the prevalence of weed seeds in wheat has been expressed by marketing authorities, indicating that much larger acreages should be treated.

Besides more widespread use of 2,4-D, more farmers have undertaken chemical control of wild oats; nearly 20,000 acres have been treated with di-allate and barban. Results have been satisfactory where farmers have followed the more exacting directions for the use of these materials compared with 2,4-D. Most wheat spraying has been by use of aircraft, reflecting the speed and economy of this method. Most aircraft are now applying at least two and often over three gallons of spray mixture per acre, following inconsistent results at lower volumes in recent years.

Pastures

Pasture Section responsibilities include pasture research and extension, pasture seed production and certification, seed testing and the immediate administration of the Agricultural Seeds Act, and the grain regulations of the Stock Foods and Medicines Act.

Continued Pasture Improvement

Interest in pasture improvement, a feature of the pattern of N.S.W. agricultural development for several years past has continued, although statistics indicate apparent reduction in annual rate of new areas sown to improved pasture. That reduced rate is largely due to the recent increased wheat acreage. The latter, particularly in south western slopes and eastern Riverina areas, occurred in country which has been under pasture for some years. The land has been brought back to cultivation, and a rotational pattern of farming is developing. The value of the pattern is reflected in the higher crop yields and wheat quality.

The most recent statistics available are for the year ending 31st March, 1963. These indicate that a net increase of 250,000 acres brought under improved pasture in that year, despite the return of old pasture land to cultivation. The actual new area sown would have been at least double this. At 30th June, 1964, the area under sown pasture is estimated to be 10,500,000 acres.

Increased Production of Certified and other Pasture Seed

A new peak was reached in production of certified seed; 2,406 tons of certified seed was produced, as against 1,569 tons in the preceding year. This was a very favourable season for subterranean clover production, but large crops of other certified species also were produced.

Farmer interest is indicated by production of an increasing number of certified species and varieties, such as the new tropical legumes and new cocksfoot and fescue varieties. Commercial production of *Glycine javanica, Dolichos lab lab, Desmodium uncinatum,* Siratro, *Lotononis bainesii,* Brignoles and Currie Cocksfoots and Demeter fescue is now established. Farmers are now requesting a certification scheme for these.

Considerable quantities of subterranean clover and *Phalaris* were exported, particularly to South America, and inquiries from their are increasing.

Local interest in seed production is facilitating commercial use of the results of pasture plant improvement programmes. A current development trend is towards specialised seed production, as against the standard practice of harvesting seed from areas not required for grazing.

Commercial Acceptance of New Pasture Plants

Even at ruling high prices, there is strong demand by farmers for seed of the new pasture plants mentioned. About 1,500 acres of the perennial summer legumes have been sown on the north coast in areas extending from Taree to the Queensland border. Further rapid expansion of use of these new pasture species is anticipated.

Research data from the "whole-farm production" trial being conducted from Wollongbar will do much to popularise the new legumes. In this trial *Glycine javanica* is supplementing the natural pasture during late summer and autumn. Progress results suggest a possible 20-40 per cent increase in butter fat production.

Pasture Research for Southern Tablelands

The Southern Tablelands areas is not served by a Departmental research station. But recent provision of moneys from the Wool Industry Research fund has enabled an experienced Departmental research agronomist to be located there. His primary responsibility will be to investigate agronomic problems which arise in the application of research findings to producers' properties.

To facilitate co-operation, C.S.I.R.O. has graciously provided an office and other facilities for location of this officer with the C.S.I.R.O. at Canberra.

Film on Seed Certification

Work on the 20-minute colour film on seed certification is about completed. The film is being made by the Commonwealth Film Unit for the Commonwealth Department of Primary Industry at the suggestion of and with the technical supervision of the N.S.W. Department of Agriculture. This film will be a very useful extension aid Australia-wide. If distributed overseas it would also assist to increase Australian seed exports.

Third Australian Grassland Conference

Fourteen Divisional officers including Head Office staff of the Pasture Section, and pasture research officers from Research Stations and Regions, attended this conference at Warburton, Victoria, in November, 1963. They, in some cases in association with officers of other Divisions, presented twelve papers.

The conference covered most aspects of pasture research and provided valuable opportunities for formal and informal discussion with officers of other States and the C.S.I.R.O. and Universities.

PASTURE RESEARCH

Pasture research was continued at 15 Agricultural Research Stations and other institutions under Departmental control and also in four regional centres. Regional research strength was further improved by appointment of the research officer to work on the Southern Tablelands. In addition to research officers' work, district advisory agronomists carried a considerable volume of local research largely under the U.P.S.E.T. programme.

The combined volume of research covered a very wide range. This for convenience is dealt with under the following headings: establishment, plant nutrition, utilisation and management, and pasture plant improvement.

Pasture Establishment Research

This is a perennial area of research. Introduction of new species, the need to establish pastures in new types of country, and new approaches to pasture establishment continually require it.

The new summer legumes were initially thought to require well prepared seed beds but further work has shown that in many cases and environments, sowing into rough seed beds is satisfactory. Recent work has shown also that satisfactory establishment, including nodulation, can be obtained over a much more extended period than was originally thought to be so. Further work on chemical seed bed preparation is proceeding.

Expanding use of aircraft for topdressing has increased the demand for information on aerial seeding. Current activities are therefore more concerned with surface seeding than with conventional seed-bed sowing.

Recent work at Glen Innes supports earlier findings at Yanco that clover competition can restrict establishment of *Phalaris* and suggests that best *Phalaris* establishment can be obtained by sowing this species first, in the spring in suitable environments, and subsequently oversowing with clover.

Pasture Plant Nutrition Research

For a long time the emphasis in plant nutrition and fertilizer investigations was directed towards the trace elements. The work has shown that trace elements except for molybdenum are not significant as limiting factors in pasture production although responses to copper, zinc and boron have been noted.

Emphasis has now returned to the major elements. Particular attention is on nitrogen, potash, and relative sulphur and phosphorus requirements where both of these are limiting.

Emphasis has also been directed towards establishment fertilizer needs. Work in this field is confirming earlier findings of need for relatively high establishment rates on other than very fertile soils.

Considerable work is now being directed towards maintenance fertilizer needs. Work on the black basaltic soils has shown relatively rapid decrease of phosphorus as well as sulphur, following initial high applications. An earlier view that, because of its relative insolubility a phosphous bank could be built up in the soil and that maintenance fertilizer could be restricted to a sulphur fertilizer seems to be incorrect. Continued use of both phosphorus and sulphur is necessary on soils normally deficient in these elements.

Because under grazing there is considerable return of plant nutrient in animal droppings and urine, the fertilizer needs of a grazed pasture may be very different from those indicated by plot investigations. To study this problem, a study possible only in a large scale grazing trial, a trial has been established at Shannon Vale Nutrition Station.

Work with nitrogenous fertilizers, including anhydrous ammonia, is in progress on temperate pastures at several centres on the coast and tablelands and also at Wollongbar on tropical grasses. Such grasses can produce big yields of forage under satisfactory nutrition but some are not compatable with pasture legumes. The economics of nitrogen fertilization will determine whether they can be used in the local stock environment.

Potash research has not indicated any major potash deficient areas. However, potash deficiencies might appear increasingly as pasture yields and stocking rates are boosted. Potash trials are therefore being continued over a wide area.

Pasture Utilization and Management Research

Current pasture utilization research is mainly towards providing as full a year's grazing as is possible from pastures using where necessary a variety of species—both in mixed pastures and as single species seasonal pastures.

The first need is an accurate knowledge of productivity of available species at different times of the year. This has been defined in respect of certain species suitable to the far north coast, and whole-farm "feed-year" trials have been established. These will not only provide information on the production possible from the use of such species, but also on the costs and returns in practical farming. Results so far indicate that substantial increased production will result, compared to what is possible on the unimproved pasture of the area.

Using different species, a feed-year production trial has been commenced in the Wingham district.

At Leeton, determination of the production pattern of a large range of species suitable to this environment has progressed.

At Hawkesbury College, summer growing grasses generally considered adapted to more northerly environments have exhibited a very wide growth curve in the central coast environment. Also at this College, determination of the nutritional value of HI ryegrass, *Phalaris* and subterranean clover in terms of sheep body weight increases is progressing.

Trials involving measurement of pasture productivity in terms of wool and meat production are being increased in co-operation with Division of Animal Industry.

Pasture Species Improvement Research

Pasture species improvement, a long term project, was actively pursued at a number of centres. As the Department is not engaged in the breeding of pasture plants, the work comprises evaluation of introductions and plants bred by other organisations. The end point is commercial utilization of new varieties or species; farmer acceptance and recognition that the new plant fills a forage need.

On this basis the summer legume and grass programme has been very successful. Some 3,000 acres of *Glycine javanica* Clarence variety, released by the Department two years ago, have been established on the lower and far north coasts during the year. Smaller areas of *Desmodium uncinatum, Lotononis bainesii* and Siratro have also been established. *Dolichos lab lab,* annual or short term perennial, is proving superior to cowpeas for late summer and autumn forage and now being widely used. The new summer grasses, *Setaria sphacelata* and *Paspalum regnellii,* are being sown as extensively as seed supplies permit.

In the south-western wheat areas an urgent need has been a perennial grass suitable for sowing with subterranean clover, adapted to areas somewhat too dry for *Phalaris.* The mediterranean summer dominant cocksfoots appear to fill this need. The Western Australian selected variety Currie is being sown extensively but will probably be replaced by more recent selections. Several varieties synthesised at the Waite Institute, South Australia, from material introduced by C.S.I.R.O. have been consistently good in both Departmental and C.S.I.R.O. tests. Arrangements are in hand for final field scale grazing trials of these by the Department and C.S.I.R.O. in co-operation. A further variety introduced by the Department is also very promising.

Other species of interest in inland areas are *Stipa hyalina,* promising as a winter pasture species in low rainfall areas, and *Eragrostis curvula.* The latter is being tested on a field scale in association with barrel medic by the Department and the N.S.W. Soil Conservation Service in co-operation, and additional trials will be made at Condobolin Research Staiton.

Creeping-rooted lucernes and lucernes with greater winter production, bred by the C.S.I.R.O., are being tested in cooperation at several centres, dryland and under irrigation.

High elevation tropical varieties of *Chloris gayana* have shown a very wide growth curve at Hawkesbury, with considerable winter growth potential. Some have reasonable cold tolerance. At Grafton it has been noted that some of these are much more vigorous than is commercial Rhodes grass. No difficulty is expected in selecting a superior variety of this useful grass.

PASTURE EXTENSION ACTIVITIES

A total of 671 pasture trials and demonstrations were conducted on farmers' properties by District agronomists; including 450 trials under the U.P.S.E.T. programme and 97 large-scale demonstrations utilizing Agricultural Extension Grant and the Dairy Industry Extension Grant Funds.

Besides providing information on species suitability, fertilizer requirements, etc., on various soil types, these demonstrations and experiments have been good extension aids and subject of numerous field days.

The Sulphur Institute grant has greatly assisted fertilizer trials.

PASTURE SEED CERTIFICATION

The amount of seed certified greatly increased over that of the previous year; 2,406 as against 1,569 tons. Seed quantities finally sealed were as follow: subterranean clover 2,220 tons; *Phalaris* 100 tons; Kangaroo Valley perennial rye 52 tons; N.S.W. perennial rye 19 tons; barrel medic 173, ten tons; and white clover five tons.

The subterranean clover total comprised the varieties Mt. Barker, Dwalganup, Bacchus Marsh, Clare, Yarloop, Marrar and Geraldton. For many years the first three comprised the bulk of the crop. There is increasing production of the local, N.S.W. variety Marrar (312 tons this year). It is replacing Bacchus Marsh and to some extent Mt. Barker and Dwalganup.

Seed Testing Laboratory

The Seed Testing Laboratory was under stress and could not handle all samples submitted. Assistance sought from the Victorian and New Zealand Laboratories was freely provided and enabled most of the work to be handled without undue delay.

Inability of the Laboratory to cope with increased work is delaying establishment of further seed certification schemes in New South Wales, placing New South Wales' growers at a disadvantage.

In the 12 months ended 30.9.63 some 400 tons of pasture seed, valued at about £220,000, was exported from Sydney. Most sales of seed to overseas countries are based on Seed Laboratory reports and often dependent on merchants' ability to meet shipping dates. Further development of the trade could hinge on the Seed Testing Laboratory providing an expeditious service for export samples.

Regulatory Activities

Regulatory activities were restricted because more of the seed inspectors' time had to be given to seed certification work, arising from increased certified seed production.

During the year 174 towns were visited, 525 stores were inspected and 455 unregistered products were detected. Legal action was taken in six cases under the Agricultural Seeds Act and in two cases under the Veterinary Surgeons Act.

Cotton

A highlight of agricultural trends in the past season was rapid development of the cotton industry. New South Wales became the leading cotton production State for the first time and this position could continue.

Production Trends.—Sowings in 1963-64 reached 11,000 acres, as against 2,359 in the previous season and 97 acres in 1959-60. Of the 11,000 acres sown, 3,400 acres was ploughed in as a result of weed competition, flooding and inferior strikes. From the 7,600 acres to be harvested the result will be about 7,000 bales, as compared with 4,000 for Queensland and 2,000 for Western Australia.

Notable increases in production are likely in the forthcoming season. New South Wales growers' declared intentions indicate a sowing of at least 22,000 acres in 1964 for the 1965 harvest.

New Ginneries.—Two more ginneries were constructed; one privately, and the other assisted by Government guarantee. The former will serve increased Namoi Valley production and the other, at Darlington Point, will serve south western production.

Development of the three ginneries in N.S.W. in the past two years has eliminated the earlier high freight charges and quality deterioration associated with transport over long distances to Brisbane.

Quality Gradings.—Despite unfavourable weather at harvest, the high gradings for lint from the early part of the harvest were encouraging. Of the first 152 bales from the Darlington Point ginnery, only two were "strict low middling". The remainder were graded "middling plus" or "middling."

Commonwealth Bounty.—The Raw Cotton Bounty Act of 1963 took effect from 1st January, 1964. Conditions for bounty payments under the new Act are based on lint quality, and a scale of discounts below and premiums above the payment of 16.125 pence per lb. for "middling one inch white" is to be determined annually. Bounty payments were previously provided on the basis of seed cotton produced.

Fibre Testing Laboratory.—Construction and equipping of a special laboratory for the scientific appraisal of fibre quality have been approved, for inclusion in a new building programme at Rydalmere. An Officer-in-Charge has been appointed and arrangements have been made to use facilities elsewhere until the Departmental laboratory is ready. These facilities will be used to direct plant breeding programmes along specified, quality lines and to conduct research into quality problems.

Breeding and Improvement.—The cotton improvement programme progressed despite interruption through loss of the cotton plant breeder and the wait for a replacement.

Some 10,500 selfings were made. Programmed testing of promising varieties, strains and selections from F3 and F4 generations continued; 110 more selections were made from lines included in the breeding nursery.

In pure seed areas, of the varieties Empire 289, Deltapine Smoothleaf and Dixie King 27, selections were also made.

Stoneville 7-02 and Austin BR 07 were promoted to seed increase in isolation.

Variety Testing.—The programme of promoting the most promising varieties, strains and selections to Stage 1 and then to Stage 2 variety trials continued. In the Stage 1 trial at Yanco, the variety Coker 124 produced the highest yield, 4,125 lb. seed cotton per acre; followed by Stoneville 7 at 3,575 lb. per acre. The varieties Acala 44 and Acala 44 WR were also very promising, as were Dixie King and Deltapine lines. At Narrabri, the varieties performed in a manner similar to that of the previous season.

In the large scale Stage 2 trials at Yanco and Narrabri, Deltapine Smoothleaf was the leading variety. Promising results were obtained also from Fox 4 and Deltapine 15.

Pure Seed Multiplication.—Highly satisfactory progress was made in the important project for rapid multiplication of pure seed of selected varieties. Sufficient seed of Empire 289 and Deltapine Smoothleaf will be available to sow the State's entire crop in 1965. Plans are also well in hand for the annual provision of "new" seed based on continued Departmental selections.

Ten more isolation areas were used in the Coleambally and Wee Waa districts for preliminary multiplication of other promising varieties.

Pure seed committees were established for the Namoi Valley and for the south west, towards ensuring an orderly supply of pure seed to commercial seed growers.

Production Research.—Research into many problems of cotton production was again conducted at the Narrabri and Yanco Agricultural Research Stations and in adjacent districts.

At Narrabri: An investigation into the optimum timing of "cut-off" irrigation revealed no significant difference in total yields of about 3,250 lb. seed cotton per acre. However, the early "cut-off" watering greatly increased the yield of the first pick, permitted easier and earlier picking through improved defoliation and facilitated destruction of crop residues at completion of harvest.

Plant populations studies revealed no significant differences in final yields from plantings varying from 13,750 to approximately 59,000 plants per acre. The denser populations, however, produced more uniform plants—of a lower height and with the lowest branches higher off the ground—and maturity was more even.

Defoliation treatments were also studied, and herbicide and insecticide trials were assisted.

At Yanco: The "method of irrigation" trial again produced best yields from the "high water" treatments. There were indications that low yields of some commercial crops are due to underwatering.

Two defoliation trials indicated the economic advantage of atlacide over four other chemicals.

A "pilot" investigation into the benefits of deep ripping produced trends which indicated the need for detailed research into this practice.

Preliminary, fertilizer requirement investigations revealed need for more detailed research into phosphate. Screening trials with compound fertilizers indicated potassium requirement trends.

Other investigations included: use of plastic and petroleum mulches; screening of pre- and post-emergence herbicides; and collaboration in entomological research.

Demonstration and Extension.—Field demonstration plots were established in potentially important cotton districts. Apart from knowledge gained on production of cotton in districts where little or no previous research had been conducted, these plots proved valuable for education of potential growers.

The 1964 Sydney Royal Show display by the Department comprised "The Growing Cotton Industry", a collaborative effort by Division of Plant Industry, Division of Information Services and others. This display was subsequently adapted for use at Narrabri and Wee Waa Shows, by invitation. It is scheduled for similar use at Forbes, Leeton and Griffith during 1964-65.

Rice

Industry Trends.—For the third successive season, a record crop was produced. The estimated total harvest was 140,000 tons, against the previous 133,489 tons record in 1962-63. In the past ten years, production of paddy has doubled as a result of improved production methods and the development of new irrigation farms.

A "cold snap" during flowering severely affected yields, particularly in the Murray Valley districts. Per acre yields were therefore less than in recent years. Despite this, the total return to growers will be almost £4,000,000.

About 75 per cent of the rice is exported. Export earnings increased from £3.4 million in 1962-63 to an anticipated £3.9 million for 1963-64.

To meet changing consumer tastes at home and abroad, the industry now produces three types of rice: Caloro (short grain), Calrose (medium grain) and Bluebonnet 50 (long grain). Previously only the Caloro type was produced. This season Calrose production increased to a record 42,000 tons.

The trend towards almost complete bulk-handling of the crop continued, with the industry planning a £500,000 programme of additional bulk conditioning and storage installations. This trend followed research by this Department, proving that harvesting at a high moisture content improves milling quality.

Industry organisations continued close co-operation with the Department, particularly through the Rice Investigations Sub-Committee of the Irrigation Research and Extension Committee. The industry organisations have subsidised the Department's rice research programme since 1956. This level of co-operation, and ready and rapid acceptance of research results, have led to the rice yield averages being the highest of all rice producing countries.

Breeding and Improvement.—The programme of quarantining all introduced rice varieties at Hawkesbury Agricultural College was continued. All 20 current introductions were declared free of disease. Other varieties from Madagascar, Surinam, Japan and the U.S.A., previously cleared through quarantine, were appraised for possible use in a crossbreeding programme at Yanco Agricultural Research Station. The special quarantine precautions have been adopted to preserve the unique disease-free status of the rice industry.

Excellent progress was made in the programme to develop varieties to replace the long-grained Bluebonnet 50. All advanced crossbreds yielded better than the latter and four were equivalent to Calrose. Yield levels of 4 tons per acre were achieved, far in excess of the accepted yield limits for these indica type long-grain varieties.

The major project investigating the causes, mechanism and genetics of sun-cracking continued. Earlier research had established that losses from sun-cracking could be substantially reduced by harvesting paddy at a high moisture content and subsequent drying. It also showed that varieties differed in susceptibility, and indicated strain variations within varieties.

This season, some 5,000 panicles of a Bluebonnet 50 x Calrose line were tagged with date of flowering as part of a basic study of the inheritance pattern of resistance to sun-cracking.

Development of laboratory methods for determination of quality standards was further investigated in co-operation with the rice chemist. Arrangements were made also to import milled samples of varieties which command premium prices on the major world markets. Their quality characteristics will be subject of detailed chemical and physical study.

The pure seed programmes for Caloro II, Calrose and Bluebonnet continued. More than 5,000 tons of pure seed was harvested in readiness for the 1964-65 season.

Other Rice Research.—With continued financial support from the industry the intensive rice research programme at Yanco Agricultural Research Station and in rice districts comprised some 40 projects and trials.

Variety testing again showed the superior yielding of Caloro II; experimental plot yields of 4.5 tons per acre compared with 4.0 for Calrose and 2.0 for Bluebonnet 50. Wombat was withdrawn from cultivation due to inferior milling quality. In Murray Valley districts, Early Caloro withstood coolness during flowering better than any other variety under test.

Standard fertilizer trials at 10 sites throughout the rice growing districts were aimed at increased knowledge of nitrogen needs over a range of soil types with varied fertility levels.

A seed rate x fertilizer rate experiment at Yanco Agricultural Research Station showed that seed rates of 120, 160 and 180 lb. per acre yielded superior to the 80 lb. per acre rate, and no advantage in fertilizer applications above 20 lb. nitrogen per acre.

Efficiencies of sources of nitrogen were investigated. Anhydrous ammonia and aqua-ammonia produced slightly higher yields than sulphate of ammonia.

Topdressing research established that application of nitrogenous fertilizer into water was as efficient as alternative methods of application. This research also provided information as to the optimum time for application.

Rice sod-seeding research over recent years has led to acceptance of this new method by several growers. Apart from economic benefits by elimination of cultivation costs and from extended grazing, some growers using rice sod-seeding also got yields in excess of many crops sown by conventional methods. Experimental plots this season produced yields of 5.5 tons per acre—the highest in trials for many years.

Aerial-sowing research previously has established correct calibration methods for the aerial dispersals of seed. This season the information was applied in a research project designed for reclaiming highly saline soil.

Plastic levees in lieu of earth banks again proved successful in experimental plantings. Arrangements have been made to examine their economics and practicability under large-scale commercial conditions.

Soil Testing.—Soil samples from about 200 rice blocks were analysed by the rice chemist at Yanco Station and fertilizer rates recommendations were given, based on these results and previous research. In the Murrumbidgee and Coleambally Irrigation Areas there was a high correlation between the recommendations based on soil sample analyses and rice yields. However, discrepancies occurred in several Murray Valley crops.

Tobacco

Industry Trend.—In the northern New South Wales tobacco growing districts, on the border rivers, around the township of Ashford and on the Mole River, some 2,800 acres of tobacco were planted for a yield average of about 1,000 lb./acre.

In the southern districts, where production had been mainly centred around the township of Barham on the Murray River, the industry has collapsed—during the 1963-64 season not an acre was planted. Popularity of tobacco growing had had a phenomenal rise there; to 519 acres in 1960-61 from a mere 25 acres in 1958-59.

In each of the 1960-61 and 1961-62 seasons, the leaf brought more than £250,000 to the Barham district; but, from 320 acres, only £80,000 in 1962-63. As a result of this shrinkage of returns, tobacco ceased to interest southern farmers and none was planted last season.

Sales.—The average price paid for the best leaf from northern New South Wales was 20 pence lower than that obtained in previous years, but good quality leaf sold readily. Poor quality and badly graded leaf met little demand and almost 20 per cent of the total offering remained uncleared at the end of the auctions. Further, negotiated sales were made but at 30th June, 1964, a considerable quantity remains unsold. This has been financially disastrous for growers.

Research and Extension.—Two agronomists, one in research and the other in extension, are located at Ashford.

Nutrition of tobacco, control of diseases and pests, and the problem of leaf tainting by fungicides and insecticides were the main research projects.

Research Station.—The Commonwealth is in process of concluding the purchase of land for the Department's Tobacco Research Station at Ashford. Funds for the Research Station project are being provided by the tobacco industry.

Linseed

Production and Consumption.—Total apparent consumption of linseed oil in Australia has been about three million gallons in each of the past three years. Australian production of linseed seed represented 36 per cent of total requirements in 1961-62, but increased remarkably to 70 per cent of requirements in 1962-63 and was estimated to have reached in 1963-64 more than 90 per cent of the total needed for the rate of oil consumption.

Further substantial increases in production would create marketing problems unless Australian usage of oil increased or a suitable export market developed.

Linseed sowings in New South Wales have increased from 7,266 acres in 1961 to 11,493 acres in 1962, to an estimated 20,000 acres in 1963 and an estimated 30,000 acres record in 1964. Many districts recorded yields of 12 to 15 bushels per acre. Some crops reached 24 bushels per acre.

Most favoured varieties were Bonnydoon, Calar, Lin-de-Tunis and Walsh.

Variety Testing.—Variety trials were at Research Stations and on farmers' properties. Outstanding were Bonnydoon Marine and Walsh. Highest yield, 30 bushels per acre, came from Marine in an irrigated trial at Narrabri.

Improvement Programme.—At Yanco Agricultural Research Station 248 linseed varieties, and lines of a world collection originally totalling some 2,000, were sown. Selections over the past four years from the lines most suited to local conditions have reduced the collection of 2,000 to about 400 lines.

At Glen Innes Agricultural Research Station part of the world collection was tested, and reduced to 129 lines. The breeding programme continued towards obtaining pasmo tolerance, winter-hardiness, resistance to shattering and lodging, and increased seed size. One hundred of the most promising lines from the breeding programme were sown for yield testing at Glen Innes, Cowra and Narrabri.

High Oil-content Lines.—The high oil-content lines RR204, KRS 1, KRS 3, KRS 26, Kameniza, NP 45 and NP 204 were sown for appraisal and seed increase.

Cultural Research.—Investigations into rate of seeding, time of sowing, and fertilizer requirements were commenced at Leeton and Narrabri Agricultural Research Stations.

Pure Seed Programme.—This was expanded during the season and now includes the varieties Bonnydoon, Calar, Hazeldean, Uruguay, Lin-de-Tunis, Marine, Walsh and C1118.

Soybeans

Australian production of soybeans is an insignificant proportion of the annual requirement of soybean oil. In 1962-63, the oil-equivalent of Australian production was 10,000 gallons; against total consumption of 1,048,722 gallons. Increasing markets also exist in the baking trade and livestock and poultry feed trade.

Sowing of only 250 acres in the past season was not a true reflection of widespread interest developed in recent years. Soybean varieties are highly sensitive to latitude and climate and to time of sowing. In the U.S.A., varieties have been classified into nine groups and the adaptability of each "group" has been determined for all States in the U.S.A. Initial steps towards similar information for New South Wales were taken last season when some 60 varieties were sown at Leeton, Yanco and Narrabri Agricultural Research Stations for pure seed increase and detailed appraisal.

Research into time of sowing, and row-spacings, was also undertaken.

Seed was distributed for 9 variety trials and 4 demonstration blocks.

Under irrigation, experimental yields of 30 to 40 bushels per acre were again obtained, indicating the potential.

Sunflowers

The main market for sunflowers in Australia in recent years has been the birdseed trade. Only in occasional years of high production has the seed been crushed to produce the excellent quality edible oil it offers. Prices offered by oil-crushers have been too low to attract growers into production, but have been dictated by the low oil content (25 per cent) in current commercial varieties. Reported overseas development of varieties with oil contents of 40 to 50 per cent has aroused interest.

Twenty-one new inbreds, hybrids and varieties were grown under quarantine at Yanco Agricultural Research Station in the past season. Samples have been submitted for analysis to determine whether high oil contents can be produced under local conditions. A further five introductions from Bulgaria, United States and Russia have been obtained for growing under quarantine in 1964.

Safflower

Production and Consumption Trends.—In the three years to 1963-64, safflower production in Australia averaged only 14 per cent of annual requirements of the oil. During the three years the total apparent Australian consumption of this oil increased from 457,827 to 852,812 gallons. Consumption for 1963-64 is expected to reach 1,350,000 gallons.

Total sowings for New South Wales have been only 300 acres in the past two years, but reports indicate that 1964 sowings might reach a record 3,500 acres. This development has been due to the excellent seed and oil yield of the new variety Gila.

Introductions.—Eight introductions from the U.S.A. were grown under quarantine at various research stations. Three of these contracted the safflower rust, previously unrecorded here. This necessitated destruction of the plantings. Five more introductions possessing high oil content and varying disease resistance have recently been sown under quarantine.

Variety Trials.—Variety trials revealed the superiority of Spineless, Gila and Orchard, and yields as high as 1,800 lb. per acre. Seed was distributed for the sowing of 10 variety trials in 1964.

Research Programme.—This was intensified. Rate of seeding and fertilizer trials were established in the South Western Agricultural Region, and investigations into time of sowing, method of sowing. deep ripping, irrigation and row-spacing were in hand at Leeton Agricultural Research Station.

Pure Seed Programme.—The pure seed scheme commenced in 1962 has been expanded and now includes 11 varieties.

Miscellaneous Oil Crops

CASTOR BEANS

Variety Search.—The search continued at Yanco Agricultural Research Station for a variety possessing the required high yield, high oil content, short fine stems, thick but brittle and spineless capsules, resistance to shattering and an adaptability to mechanised harvesting.

Lynn, recently developed in the U.S.A., was tested and five new varieties were introduced from Morocco.

Seed Increase Programme.—Arrangements were made for the most promising of the varieties grown in recent years to be seed increased in isolation.

SESAME

Introductions and Seed Increase Programme.—The programme of varietal introduction continued, with six new varieties from Morocco.

Arrangements have been made to seed increase the most promising of the introductions already tested at Yanco Agricultural Research Station, in an endeavour to establish varietal suitability to irrigated conditions in New South Wales. Most introduced varieties have been rejected due to heavy shattering losses.

RAPE SEED

Introductions.—As a result of increasing interest in rape seed production for oil extraction, introduction from Italy and The Netherlands of recently developed varieties possessing high seed and oil yields has been arranged.

TUNG NUT

Propagation Methods.—A small plantation was maintained at Grafton Agricultural Research Station for observation purposes. Work designed to propagate the best strains by budding and/or grafting has been continued.

PYRETHRUM

Not Economic.—Investigations proceeded at Glen Innes, and arrangements were made for the various lines to be analysed by a recognised authority in the United Kingdom. Not only was the total content of pyrethrins low but there was an abnormal ratio of pyrethrin I to pyrethrin II. These results vindicated the opinion of this Department that pyrethrum production with varieties at present available, and perhaps with any variety, is not an economic proposition in New South Wales.

These investigations have added support to the evidence from overseas that successful production of pyrethrum can only be achieved on highlands of 6,000 to 8,000 feet in a narrow belt north and south of the equator. Consequently, in response to the numerous enquiries received following attempted promotion by a private organisation, this Department has advised against production in this State.

Some Miscellaneous Plants

Canary Seed.—Production areas decreased from an estimated 1,500 acres in 1962-63 to about 500 acres. Seed of four new varieties was increased for comparisons in the coming season.

Peanuts.—A further decline in acreage occurred. Despite late sowings, due to low rainfall, final yields averaged well.

Corkwood (Duboisia spp.).—Corkwood leaves were again in high demand by processors and exporters. Harvesting was restricted to naturally-occurring trees. Attempts to establish plantations have not as yet proved successful.

Oil Poppy.—Investigations towards determining the most suitable variety or strain for local conditions were continued.

Others.—Limited attention was given to several other crops, including lavender, peppermint, buckwheat, ramie, jute, giant lily and mustard.

Wheat

The Wheat Season.—The 1963-64 weather in general favoured winter cereals. Rainfall in most months was above average. Some crops had to be re-sown, through waterlogging. The early spring was dry but this helped to prevent any major outbreak of rust. The only crops that suffered moisture stress were in marginal areas of the central west.

Wet weather in the north after grain ripening delayed harvesting, caused bleaching and swelling of the grain, and reduced bushel weights. For over 10,000,000 bushels the bushel weight was reduced to less than the acceptable minimum for F.A.Q. Such wheat received a dockage. Rapid growth of weeds after the heavy rains further delayed harvesting.

Wheat Production Again a Record.—Total production and yield per acre were at record levels. Of 5,200,000 acres sown to wheat for all purposes, 5,000,000 acres were for grain. About 29 per cent. was in the Northern Division, 34 per cent. in the Central Division, and 37 per cent. in the Southern Division. Of the N.S.W. wheat delivered to the Australian Wheat Board, some 33 per cent. was from the north.

Wheat receivals by the Australian Wheat Board in N.S.W. totalled 110,467,000 bushels (104,332,000 bushels in bulk); compared with 98,194,000 from the previous crop. Including also the N.S.W. grain delivered to the Board through the Victorian Railway System, about 5,160,000 bushels, and about 7,000,000 bushels retained on farms for seed and feed purposes, *the record* 1963-64 *harvest yielded some* 123,000,000 *bushels*. This was about 14,000,000 bushels more than the previous record (1962-63). From these approximations, yet to be confirmed, the 1963-64 yield per acre is calculated as in excess of 24 bushels—easily a record.

Premium Wheats.—Local mills paid premiums amounting to about £218,000 on some 3,000,000 bushels. In the previous year the figures were £177,470 and 3,296,194 bushels.

Most of the local premium purchases of the 1963-64 wheat crop comprised hard varieties, 2,278,959 bushels. Soft variety and local premium sales totalled 694,739 bushels. Premium averages were 21.9d. per bushel for hard varieties (15.1d. in 1962-63), and 3d. per soft varieties (4.4d. in 1962-63). Overall premium average was 17.5d. per bushel (12.9d. in 1962-63). Highest premium for an individual parcel was 57d.

Highest premium averages were paid for the macaroni wheat Dural (30.6d.), the winter wheat Windebri (28.4d.), and the spring wheat Koda (25.5d.).

Premium purchases of Dural, about 155,800 bushels, were almost treble those of 1962-63. This indicated the continued growth of interest in this type.

The most popular hard varieties, as gauged by premium acceptance quantities, were Mengavi 28.8 per cent, Koda 18.7 per cent, Gamenya 13.6 per cent, and Spica 12.8 per cent. These four varieties totalled 74 per cent of the hard wheat premium deliveries.

Two varieties, Pinnacle 46.3 per cent and Heron 11.9 per cent, accounted for almost 60 per cent of the soft varieties for which local premiums were paid.

A further 4,250,000 bushels of wheat tested for protein were received at selected receival points for eventual local or overseas sales.

F.A.Q. Standard.—Again, two f.a.q. standards were declared: one for northern f.a.q. wheat, which comprised 33 per cent of the receivals, at 63¼ lb. per bushel Schopper weight, compared with 64¼ lb. per bushel in the previous year; and one for the southern and western wheats combined, which comprised 67 per cent of the receivals, at 64¼ lb. per bushel, compared with 63¼ lb. in the previous year. The wheat proteins of the f.a.q., northern 11.5 per cent and southern-western 10.5 per cent, were almost the same as the previous year.

Wheat Variety Popularities.—The latest available census of wheat varieties is for the 1962-63 season. It shows important changes in the popularity of wheat varieties since the 1960-61 season. Glenwari, the most popular since 1959, retained its position, but its percentage of area dropped from 20.4 to 13.1 over the last two seasons. Bencubbin and Gabo, both very popular for some years past, receded from second and third place in 1960-61 to fifth and sixth places in 1962-63 with percentage areas of 6.6 and 5.4, respectively.

Three comparatively new varieties, Olympic, Heron and Mengavi, filled second, third and fourth places, with percentage areas of 9.2, 9.1 and 8.2, respectively. Heron and Mengavi areas were insignficant in 1960-61. Olympic was released in 1956, Heron in 1959, and Mengavi in 1960.

Wheat Variety Recommendations.—Variety recommendations were made for each Agricultural Region, as for 1963 sowings.

Consistent with the views of the Advisory Committee on Wheat Production and Marketing, only soft varieties were included in 1964 sowing recommendations for the area east and south of a line running through Merriwa, Coolah, Neilrex, Wellington, Eugowra, Grenfell, Bribbaree, Barellan and Griffith. Varieties producing a hard grain, e.g., Winglen, Windebri, Eureka, Spica and Falcon, were excluded from recommendations in this "soft" area.

Festival and Koda were excluded from all recommendations because of yields inferior to such new varieties as Gamenya and Mengavi.

Olympic and Heron were recommended for a wider area, because of generally good yields and adaptability.

Gamenya, resistant to most of the prevalent strains of stem rust, and very popular in the north-west, was recommended for many central and southern areas because of good adaptability.

Winter Wheats.—Despite no available winter wheat resistant to the prevalent stem rust strains, north-western interest in winter wheats was maintained. An appreciable acreage was previously grown there for grazing and grain. In 1962-63, the latest season for which variety statistics are available, the Departmental winter wheats Winglen and Windebri were sown on 133,800 acres—more than double the acreage sown to all winter wheats in 1959-60.

Premiums for 61,000 bushels of winter wheat from the 1963-64 harvest were paid by local millers. Highest individual premium was for a parcel of Windebri, 56d. per bushel.

Durum Wheats (*see also under "Premium Wheats"*).—Continued expansion of grower and miller interest in Dural, a macaroni wheat bred by this Department, was apparent in 1963-64. North-western growers sowed more Dural than the 5,826 acres sown in 1962-63.

Premium purchases of Dural from the 1963-64 harvest approximated 155,800 bushels, almost treble those of 1962-63; and premium average was 30.6d. per bushel, as against 32d. in the previous year.

A report by Division of Marketing and Agricultural Economics in connection with marketing of durum wheat revealed that local production has increased substantially over the last few years. An area of at least 30,000 acres is estimated as now needed to meet local requirements, especially if all spaghetti and macaroni products are manufactured only from durum semolinas. The report expressed the view that Australia could enter the export trade for durum wheat, but increased production is the current primary need.

Wheat Quality.—The New South Wales Advisory Committee on Wheat Production and Marketing completed its main task and submitted the report to the Minister. Publication was approved in November, 1963. The Committee was set up by the Minister to investigate problems related to wheat quality as it affects production and marketing of this commodity.

Consistent with one of the main conclusions of the report, the 1964 wheat variety recommendations were made bearing in mind the desirability of confining hard and soft varieties in separate zones—the first time this has been done. The Cereal Specialist, as Secretary of the Committee, spent a lot of time on the project. It requires consultation with the Grain Elevators Board, Australian Wheat Broad, Bread Research Institute of Australia, Commonwealth Department of Primary Industry, University of Sydney, and numerous other organisations associated with wheat industry.

Implementation of the Committee's recommendations is designed to align with market demands all phases of wheat production from research, breeding, testing, release, and recommendation of new varieties, to commercial cultivation.

Co-operation of the Chemistry Branch led to valuable information on quality of new varieties under field test. Arrangements were made for supply of some 750 grain samples from numerous centres throughout the wheatbelt for milling and baking tests. Besides these routine Departmental tests, uniform quality testing of four promising crossbreds under consideration for release or recommendation was done by collaborating laboratories. Following the 1963 harvest uniform-quality tests, the Standing Advisory Committee on Wheat agreed to recommend the new varieties Festiguay and Mendos for growing in the north-western wheatbelt in 1964.

Quality Judging at Royal Show.—In the Open Wheat Classes at the 1964 Sydney Royal Show:—In the soft bread-wheat class the Departmental variety Heron was outstanding, judged on bench characteristics; in the medium strong bread-wheat classes all but one entry was of the Departmental variety Falcon; in the strong bread-wheat class, outstanding entries on the bench were two samples of Spica and a sample of Eureka. There was only one entry each in the hard blending and durum wheat classes. Judged on milling and baking quality and bench characteristics combined, Heron was Champion soft bread-wheat, Falcon was Champion medium strong bread-wheat, and Spica was Champion strong bread-wheat.

Wheat Variety Trials.—Promising new varieties were included in trials on farmers properties and the Research Stations. Useful information was gained on yield, adaptability, agronomic aspects, and the milling and baking quality of new and established varieties. Randomised and replicated variety trials were conducted with 70 farmers, under supervision of 21 District agronomists, testing 21 varieties. In addition, detailed variety trials were conducted on six Research Stations in the wheatbelt, comparing a large number of promising crossbreds and new varieties with standard varieties. The results were used in preparing the details of wheat variety recommendations throughout the State.

New varieties tested were Gamenya, Mengavi, Gabo, Olympic st. A. 103, Festiguay and Mendos.

Gamenya, a backcross derivative from Gabo, was again the outstanding early maturing variety in the north. In central and southern areas it also performed well, comparing favourably with Falcon, but was inferior to Heron.

Mengavi yielded approximately the same as Gabo but was inferior to Gamenya.

Mendos, a newly released variety, yielded approximately the same as Gabo and Mengavi. Mendos combines the differing rust resistances of Gabo, Mengavi and Spica and is at present resistant to all the races of rust present in the field. In baking quality it is superior to Mengavi and Gamenya, and equivalent to Gabo.

Festiguay, another released during the past year, is a mid-season to late variety and under normal temperature is resistant to all races of rust in the field. Having a higher cold requirement than most other commercial varieties it can be sown early and its prostrate early growth prevents normal winter frost injury. It yielded as well as or better than Eureka in northern areas but generally has been a mediocre performer in central and southern areas. Its baking quality is equivalent to that of Eureka.

Gabo, a midseason variety of good baking quality from Queensland, yielded equivalent to Gabo.

Olympic st. A.103 was compared with Olympic in a number of trials. The selection is a rather more even line, with shorter straw, and slightly later in maturity.

KF Heron, a back cross line of Heron, with resistance to some of the prevalent races of rust, has been promoted to farmers' experiment plots because its yield is equal to or better than that of Heron.

Other varieties of interest were some high-yielding rust resistant semi-dwarf varieties from overseas. Two of these, Chili IB and Mexico 120, will be tested on Research Stations in central and southern areas in the 1964-65 season.

Soil Fertility and Rotation Experiments at Condobolin.—This experiment, at Condobolin Agricultural Research Station, has completed its eighth year. Further valuable information was obtained. A conference at Condobolin this year, to review results to date and consider suggestions, decided to make only minor alterations at least until a cycle of twelve years has elapsed.

Rotation Trial, Trangie.—The trial comparing volunteer and sown pasture in effect on subsequent wheat yields continued at Trangie Agricultural Research Station. It has been decided that the pasture phase has been of sufficient duration, and that the arable phase should now commence.

Wheat Fertilizer Experiments.—The Wheat Uniform Fertilizer trials carried out in 1959-61 have now been statistically analysed.

Varying responses to applications of superphosphate have occurred over a wide range of climatic conditions and soils throughout the State, including some northern areas where superphosphate had not been previously used nor thought to be necessary. In central and southern areas, economic responses were obtained from heavier applications than are generally applied.

Nitrogen, in the form of urea, applied as a topdressing in late winter, generally increased grain protein content but in most trials little positive yield response was obtained. In fact in some trials there was a negative response.

Application of a mixture of potash and minor elements generally failed to give positive yield responses. In some trials the mixture markedly depressed yields.

Applied Nitrogen on Wheat Lands.—Developments in the use of nitrogenous fertilizers on wheat lands in Western Australia were studied by the Cereal Specialist, during a fortnight's visit to Western Australia in October, 1963. His report indicated that responses from applied nitrogen within the New South Wales wheatbelt were most likely to occur under the following conditions, in conjunction with adequate superphosphate:—on lighter soil types within the eastern half of the wheatbelt, subject of more reliable rainfall; on heavily Skeleton Weed infested light loams and medium-red loams within the wheatbelt, particularly where there has been a long history of cereal cropping; on stubble-sown crops, particularly where multiple-cropping is temporarily practised following a period under pasture, and especially on light loams or medium-red loams.

Field Wheat Competitions.—Six Divisional championships were conducted by the Royal Agricultural Society of N.S.W. The field judging of most of the local and all championship competitions were carried out by Division of Plant Industry officers. Approximately 740 crops were entered, in 76 local competitions. Winning championship crops were:—

Northern Division—Mengavi, estimated 56 bus. per acre.
Northern Slopes Division—Mengavi, estimated 60 bus. per acre.
Western Division—Gamenya, estimated 61 bus. per acre.
Central Slopes Division—Falcon, estimated 51 bus. per acre.
Riverina Division—Falcon, estimated 53 bus. per acre.
Southern Slopes Division—Olympic, estimated 52 bus. per acre.

Oats

Oat Production.—Total oat sowings in 1963-64 were esti- ıated as 1,470,000 acres; well below the anticipated total. .bout 42 per cent of the sown area was for straight out razing, and many crops grown primarily for grain were used lso to provide early grazing. Grain production, though above verage, was well below that of the record 1958-59 season, vhen 1,627,000 acres were sown for all purposes and 7,638,000 bushels of grain were harvested from 1,130,000 cres for a total production of 27,638,000 bushels and an verage yield of 24.5 bushels per acre. This year the grain arvest totalled about 17,000,000 bushels and oaten hay otalled about 96,000 tons.

Oat Variety Popularity.—The two leading varieties, Belar nd Algerian, are declining in popularity. Belar fell from 0.5 per cent in 1959-60 to 32.8 per cent in 1961-62, and lgerian fell from 23.5 per cent in 1959-60 to 20.2 per cent n 1961-62 (latest available statistics). It is of interest that lgerian, still the second leading variety, has been grown for lmost 100 years. Fulmark and Avon are showing the fastest ain in popularity.

Oat Variety Trials.—Oat variety trials were conducted with 4 farmers, under supervision of 23 District Agronomists, test- ng 18 varieties. Variety trials were conducted also at nine Research Stations.

Oat Variety Performances.—New varieties tested included V.R. Bke.W4464, V.R. Bke.F x WF W4587, and V.R. Boppy Belar W4606. Yields were generally good. Grazings were in some cases delayed by wet weather in the winter. This led to apid, lush growth which was damaged by frost in the late winter and by stem rust in the spring.

In central and southern areas Avon was the best of the named varieties, for grain yield, and Cooba the best for graz- ng and grain recovery. However, these varieties were not so successful in the north.

The Glen Innes hybrids W4587 and W4606 continued to perform well. W4587, a midseason maturing variety, is a possible replacement for Belar in the north. Likewise W4606 compares favourably with Algerian.

W4464 continued to give very high grain yields, particularly in the lower rainfall areas. It also has very strong straw. Its main weakness is a low grain/hull ratio.

Klein 69B performed well as a grazing variety for the coast. There it outyields all other varieties. It also does well as a dual purpose variety on the tablelands and northern slopes.

Oat Variety Recommendations.—As in the case of wheat, oat varieties were recommended for each Agricultural Region for 1964 sowings. In each Region separate recommendations were made for (1) heavy grazing and grain, (2) light grazing and grain, (3) grain.

No major changes were made in the recommendations. Some varieties, such as Cooba, were recommended in a greater number of regions.

Oat Improvement in Northern N.S.W.—The northern oat improvement programme continued, with headquarters at Glen Innes. Among the named varieties the best results were achieved by the varieties Cooba and Klein 69B, for green fodder production, and by Klein 69B and Algerian for grain recovery. One unnamed hybrid (Fulghum x Garry) x (V.R.A.F. x V.R.S.F.) 856 G59 yielded well in comparison with the best of standard varieties.

A uniform set of varieties comprising promising hybrids and appropriate checks was sown at Tamworth, Inverell, Gunnedah and Narrabri. This trial provided valuable information on adaptability of the various lines over a wide area. Both grazing cuts and grain yields were obtained.

The barley yellow dwarf virus caused damage, particularly at Tamworth, but enabled determination of varietal reactions. Moderate to severe stem rust occurred in the breeding rows; Garry still showed tolerance but its resistance was lower than in previous years.

The crown rust nursery at Grafton was sown later than usual, because of earlier flooding. This, and the dry weather in late winter and early spring, resulted in less severe crown rust than in most years. However, there was sufficient infection to determine comparative varietal reaction.

Inoculations with loose smut collected in Coonabarabran district suggested that a new strain of smut capable of attacking the variety Acacia has been discovered, but further tests are needed.

Some selection was made in the breeding rows for resistance to lodging, shattering and second growth.

Two promising hybrids V.R. Bke. F x W.F. W4587 and V. R. Boppy. Belar W4606 were continued in tests. These further confirmed their promise as possible replacements, respectively, for Belar and Algerian, in the north.

W4587 has been distributed to registered seed growers for preliminary seed increase, pending final determinations in regard to naming and release.

Rates of Seed and Fertilizer for Grazing Oats, Cowra.—A trial to determine optimum rates of seed, nitrogen and phosphorus for grazing oats (variety Fulghum) was carried out at Cowra Research Station. The trial was sown on 20th March. Four grazings were obtained, viz., 6th May, 29th May, 1st July and 6th August.

The best combination of treatments was 120 lb. seed/acre, 1 cwt. sulphate of ammonia/acre and 1 cwt. superphosphate/acre. Statistical analysis showed the results to be significant.

Material from the grazing cuts was also analysed for protein content. Protein content decreased with each succeeding cut. Increase in rates of seed also decreased protein content. Addition of sulphate of ammonia increased the protein content but the only response from superphosphate was a positive response at the time of the third cut.

Barley

Production.—Farmer interest in this crop was maintained. There was only a slight reduction in acreage and yield compared with the previous year's. Statistics are not available for 1963-64 but in 1962-63 some 221,000 acres sown to barley for grain, in a total sowing of 254,000 acres, was the highest ever recorded. Grain production of 5,361,000 bushels in that year also was a record (2-row: 3,328,000 bushels; 6-row: 2,033,000 bushels).

Barley Variety Trials.—Recently introduced two-row and six-row barley varieties, including Resibee, Anabee, Proctor, Noyep and Beecher, were tested on farmers' properties in comparison with standard varieties such as Ablyn, Abyssinian and Prior. Randomised and replicated barley variety trials were conducted with 20 co-operating farmers, under supervision of 14 District Agronomists, testing eight varieties.

Barley Variety Performance.—Of the six-row varieties, Abyssinian gave very good results wherever good rainfall was well distributed during the growing season. Ablyn yielded well in the drier areas but Beecher, a recent introduction from Western Australia, compared well with it.

Of the two-row varieties, Research performed well in good rainfall areas. Prior and Noyep, which are earlier maturing, yielded well in the drier districts.

Cereal Rye

Production.—Latest available production statistics are for the 1962-63 season, when 30,606 bushels of grain were harvested from 1,747 acres out of a total 6.813 acres sown for all purposes including green fodder. Grain yield in 1963-64 is estimated to have been less than at the 1962-63 harvest. Highest recorded New South Wales average and grain production was in 1939, when 193,000 bushels were harvested from 12,196 acres sown for grain.

An increased acreage is anticipated to have been sown in 1964, following the offer of a Sydney firm of millers for a guaranteed price for grain contracted from the 1964 rye crop.

Seed Stocks.—Basic seed stocks of the varieties Weethalle and strain 8 were maintained.

Wheat, Oats, Barley, Rye Grazing Trials

At Glen Innes Research Station, varieties of wheat, oats, barley and rye were compared in two trials, one heavy grazing and the other light grazing. Both trials were allowed to recover for grain. At both grazing levels oats, represented by the variety Klein 69B, was greatly superior to the other cereals for grazing and for grain. Wheat (variety Winglen) and barley (variety Abyssinian) were about equal for green fodder in the severe grazing trial, but wheat was superior to barley for green fodder in the lenient grazing trial. Wheat and oats each recovered poorly in both trials. Rye (variety N.I.A.B.) performed poorly for green fodder and for grazing recovery in both trials.

A similar trial was carried out at Cowra Research Station. Three grazing cuts were made. The highest total yield was from barley; followed by oats, wheat and rye in that order. The earliest grazing was produced by barley and rye, as they gave the highest yields in the first cut. Wheat and oats were more palatable to sheep than were the barley and rye.

Wheat, Oats, Barley Pure Seed Production

Expanded Production.—Pure seed production expanded. Supplies of pure seed of the recommended and promising varieties of wheat, oats and barley were maintained on eight Agricultural Research Stations and distributed through registered seed growers. In 1963-64, foundation seed sowings on Research Stations totalled (with 1962-63 figures in brackets) 101 (75) acres of wheat, 69 (44) acres of oats and 26 (19) acres of barley. In addition, and associated with the pure seed production schemes on Research Stations, initial selection and preliminary increase of wheat and oats were conducted at Temora Research Station, of barley at Wagga Agricultural College, and of some oat varieties, suitable for northern conditions, at Glen Innes Research Station.

Registered growers' participation in the Registered Cereal Seed Scheme expanded. Altogether (with 1962-63 figures in brackets), 139 (119) registered seed wheat growers working under the supervision of 22 District Agronomists throughout the wheatbelt, using foundation seed supplied by this Department, undertook seed increase of 15 (19) wheat varieties; 99 (93) registered seed oat growers in 23 District Agronomists' areas carried out seed increase of 12 (14) oat varieties; and 28 (20) registered seed barley growers undertook pure seed production of 6 (7) barley varieties.

Treatment of Pure Seed Wheat for Loose Smut Control.—Loose smut is becoming of greater importance in wheat and barley. In the past, the only effective control has been by treating the seed with hot water. This is cumbersome and risky, as the water must be kept at certain temperatures for a specified time to ensure death of the loose smut spores and at the same time that germination of the seed is not adversely affected.

A recent trial at Temora Research Station has suggested that loose smut of wheat can be as effectively controlled by soaking the seed in hot water at a single temperature as by the three treatments at different temperatures. A similar trial for treatment of loose smut in barley is now in progress.

Maize

Production Trends.—There was a 15 per cent reduction in maize acreage; about 45,000 acres were harvested for grain. The crops were heavy yielding, with above average quality grain. Serious flooding on the Hawkesbury and Hunter Rivers in June caused loss and damage of about 1,000 acres just prior to harvest.

Machine harvesting was general. Bulk handling was undertaken for the first time by a few growers. Artificial drying of the harvested maize grain also was undertaken by a few in the Maitland district.

Nitrogen use increased. Anhydrous ammonia was used to some extent. Economical responses were governed by soil type and the cropping history.

More interest was taken in chemical weed control. Control of grasses by atrazine and simazine was good in some cases but disappointing in others.

Utilization of maize grain for pig and dairy stock feeding was general on the coast. Very little coastal grain moved from the centre of production.

Fertility-restorer Hybrids Trial.—Trials undertaken with eight single crosses and six double cross hybrids in two forms indicated no significant difference between the fertility-restorer hybrids and their normal counterparts.

Hybrid Maize Improvement Programme.—Breeding continued at Grafton Agricultural Research Station for late and midseason maturing hybrids, and at Glen Innes Agricultural Research Station for early maturing hybrids. Also, lines were introduced from overseas countries and handled under quarantine at the Leeton Agricultural Research Station. Bird damage to breeding plots caused loss of seed at each centre.

At Grafton the development and maintenance of inbred lines continued; 150 inbreds were maintained by hand pollination and 120 unfixed lines were selected and inbred for another generation. Inbred material was obtained from Nyasaland for selection and seed increase. No new inbred line was named.

Also at Grafton, 294 open pollinated ears from 10 varieties were investigated as a source for new inbred lines. Ninety-eight inbred lines were tested for general combining ability while 35 inbred lines with proven combining ability were yield tested.

Tests with experimental hybrids continued. Forty-nine such hybrids were included in the late maturing trial and 64 in the midseason maturing trial. The hybrid G.H. 342 with pedigree (21 x FF4) x (25 x 7) again performed well in yield tests, outyielding G.H. 128. Release of the new hybrid has been planned.

At Glen Innes, irrigation facilities assisted inbred maintenance work. Material from the 1962-63 inbred development nursery was inbred for another generation.

No new inbred was named, but work to correct some anomalies with existing inbreds was undertaken. Derivatives of inbred K4 continued to show promise and although slightly later than the original line they again proved much superior in standing ability.

Inbred B15 continued to show barrenness, and the release of hybrids superior in yielding ability to hybrids at present in commercial production was therefore held in abeyance. The backcrossing project to eliminate barrenness of inbred B15 met with only limited success.

All possible combinations of inbreds 38-11, Wf9, K4, 701, C103, OH43, OH45, M14, H10, C121E, M11R4, M11451, PB25, K712, R159, and R134 were tested. Inbreds B15, K159, 187-2 and K148 were removed from the series because of defects.

The derivatives of inbred C103, free from tight husk or "silk balling" sterility, were also grown. Further selections were made from them.

Twenty-six open pollinated varieties from the Australian variety collection were investigated as a source of inbred development. Selections taken from the 1962-63 inbred area were sown and developed a stage further. A few lines continued to show promise, but the rejection was heavy.

Double cross experimental hybrids, 125 in all, synthesised on the basis of yield prediction work undertaken by the Biometrician Branch, were tested. The best yield results unfortunately were obtained with hybrids containing inbreds with bad defects, namely B15 and K159.

Male Sterility Programme.—Work to convert inbreds to the male sterile and restorer forms continued.

At Grafton Agricultural Research Station, conversion of 11 inbreds to the male sterile form and three to the fertility restoring form was finalised. In addition, 35 inbreds were taken a step nearer to conversion.

Two inbreds, namely 61 and DT338, noted previously to be segregating for tassel fertility in crosses with male sterile cytoplasm, were test-crossed and non restorer sub lines were isolated. Further test-crosses were made to isolate restorer lines from these inbreds.

At Glen Innes Agricultural Research Station the backcrossing project to develop Eckhardt isolates from all inbreds continued. Fifty selections of the inbred 701 Eckhardt isolates were grown and a few apparently fertile lines were selected. One apparently fully fertile line of 701 selected was homozygous for white core colour.

Commercial seed production of the early maturing hybrid N.E.H. 7 was undertaken by the male sterile method for the first time.

Male sterile and restorer inbreds for commercial seed production of hybrid G.H. 128 were further increased by foundation seed growers. Difficulty was experienced with the synchronisation of inbreds 25R and 23R. This problem was given considerable attention. Intensive selection for good pollen production plant type with proper synchronisation was required.

HELMINTHOSPORIUM TURCICUM *Investigations.*—Loss of maize through leaf blight (*Helminthosporium turcicum*) was less than normal, but sufficient to emphasise again the need for an early maturing hybrid with blight resistance.

The co-operative programme between Glen Innes and Grafton Agricultural Research Stations to develop early maturing blight-resistant lines continued. A full range of crosses and back-crosses between 15 Glen Innes early inbreds and eight leaf blight resistant Grafton inbreds was sown, and some material was successfully rated for resistance.

Most local resistant inbreds were not capable of transmitting their resistance in crosses with susceptible lines. The most promising sources of resistance were inbreds NN1, HB and 21H. Inbreds C103 and K148 showed some resistance and in crosses with resistant inbreds produced progeny of high resistance.

Local and introduced inbreds, 128 in all, were also screened. A number of new sources of resistance were identified. Few worthwhile results were obtained from the screening of 130 open pollinated varieties, due to seasonal conditions.

Seed of A. L. Hooker's single gene resistance source A was received from U.S.A. Initial seedling tests for resistance were not succesful, due to seasonal conditions, and plans were made to cross and test this inbred with selected Glen Innes blight-susceptible inbreds.

Screenings for Other Diseases.—Apart from the leaf blight resistance programme, a number of inbreds and their various hybrids were tested for their reaction to root, stalk and ear rots. A selection of various inbreds and hybrids was also forwarded to Atherton, North Queensland, in co-operative trials with the Queensland Department of Primary Industries for special disease sceening.

Hybrid Maize Seed Certification.—Under the Hybrid Maize Seed Certification Scheme 48 growers registered 530 acres, compared with 46 growers and 517 acres in the previous season. Growing conditions were ideal and excellent quality seed was produced. Record production was anticipated, estimated at over 20,000 bushels, compared with 15,507 bushels from the previous season.

The late maturing hybrid G.H. 128 and midseason maturing hybrid G.M. 211 increased in popularity and dominated the coastal maize acreage. The registered seed areas of these two hybrids increased, and hybrid G.H. 128 comprised almost 80 per cent of the total seed area. About 16,000 bushels of G.H. 128 seed was produced, compared with 11,454 bushels in the 1962-63 season. The record production of G.H. 128 during the season led to a 33⅓ per cent reduction in the price of this seed to the commercial grower.

Hybrid N.E.H. 7 was produced commercially by the male sterile method.

About 38 per cent of certified seed of the hybrids G.H. 128. G.H. 134 and G.M. 211 produced in New South Wales was disposed of to Queensland producers.

Inbred material was produced at the Grafton and Glen Innes Agricultural Research Stations and made available to seed producers. Due to adverse seasonal conditions limited quantities of some lines only were available. Inbreds in the male sterile and restorer forms to permit seed production of G.H. 128 by the male sterile method were produced to the fullest extent and distributed to selected foundation seed growers.

Twenty-nine acres of sweet corn seed comprising five acres of Golden Cross Bantam and 24 acres of Iochief were produced in the Leeton district for certification.

Hybrid Maize District Trials.—Forty-six trials for grain production were organised; 12 with early maturing hybrids, eight with very early maturing hybrids, 13 with midseason maturing hybrids, and 13 with late maturing hybrids. The Queensland Department again co-operated by testing Departmental hybrids and inbred material on the Atherton Tableland.

Hybrids G.H. 128, G.H. 134 and G.M. 211 again performed well in the late and midseason maturing trials; reflected in the fact they occupy over 80 per cent of the coastal maize areas.

A new late maturing hybrid G.H. 342 once again compared favourably with hybrids in commercial use. Arrangements have been made for its release and commercial seed production.

The early maturing hybrid N.E.H. 7 maintained its yield and popularity in the Tumut-Gundagai district, where it occupied 80 per cent of the maize area sown, but in other districts it was not extensively used. Experimental hybrids N.E.H. 1066, N.E.H. 1151 and N.E.H. 1004 yielded highly and better than N.E.H. 7 in trials, but release was held in abeyance because of some difficulties in seed production.

Hybrids produced by the Shand Selected Seed Company performed well in trials and were extensively used commercially. Hybrid D.S. 606 occupied most of the Mudgee area sown to maize and one crop of nine acres yielded 200 bushels per acre.

Maize Fertilizer Trials.—These were again conducted, with conflicting results due to seasonal conditions. Some good responses to nitrogen were obtained, but there were some equally good results where no fertilizer was used.

Wireworm Control in Maize.—Work was undertaken at Glen Innes Agricultural Research Station; using five rates of dieldrin from ½-2 lb. a.i.acre, heptachlor at 1½ lb.acre and distyston at 1 lb. a.i.acre. Initial results indicated that dieldrin at approximately ¾ lb. a.i.acre gave good control of wireworm.

Hybrid Sweet Corn

Production Trends.—The sweet corn acreage was similar to that of the previous season. Approximately 2,000 acres were grown in the districts of Tumut, Gundagai, Windsor, Richmond, Bathurst and Mudgee under contract to canning firms. Production was satisfactory, although Bathurst crops were reduced by frost in February. Yield average was approxitmately 3½ tons per acre.

Hybrids Iochief and Golden Cross Bantam occupied the total sweet corn acreage. The former was the more popular. It was sown on 90 per cent. of the acreage, for processing purposes.

Improvement Programme.—Considerable interest was taken in sweet corn quality. Inbred material to develop superior hybrids was introduced, by the Department and private firms, and sown under quarantine. Initial impressions of some of this material have been disappointing.

Seed Certification Scheme.—29 acres of hybrid sweet corn seen to supply canners' requirements were produced under the Department's Seed Certification Scheme.

Parental inbreds for sweet corn hybrids were forwarded to New Zealand to help seed production.

Hybrid Popcorn

Production Trends.—Approximately 1,000 acres were cropped, under contract to processors in the Glen Innes, Armidale, Tamworth and Mudgee districts. Production, about 20,000 bushels, was about equal to that of the previous season.

Hybrids D.S. 518P and D.S. 519P occupied the whole of the area sown.

The newly formed company Blevins Purkiss Pty. Ltd., Armidale intensified its publicity and sales and increasing quantities of popcorn were exported.

Improvement Programme.—Assistance was given to Blevins Purkiss Pty. Ltd. with breeding material to develop superior hybrids. A small seed area of a new hybrid P140 was certified for the company, for larger scale planting.

Grain Sorghum

Production Trends.—Dry conditions at sowing time slightly reduced the grain sorghum acreage but about 75,000 acres were sown, compared with 80,000 acres in the previous season. Highest yields came from early sown crops. Some crops failed owing to a heatwave.

There was a steady demand for sorghum grain by stockfeed manufacturers and prices obtained during the season of £18-20 per ton were satisfactory.

Farmer interest in grain sorghum has increased with the advent of hybrids. Hybrids comprised some 50 per cent. of the sowings. The crop was used by some farmers for the first time on areas which could not be sown to wheat during the winter months because of wet soil conditions.

About 100 per cent. increase in acreage occurred in southern irrigation districts and yield averages of 50-60 bushels were obtained. Most of the grain produced in the south was handled in bulk, and marketed in Victoria.

Waxy Sorghum.—Wheat Industries (Aust.) Pty. Ltd. maintained production of waxy sorghum starch and 5,000-6,000 acres of the variety Waxy Combine Kafir were sown for waxy starch extraction.

Progress of Hybrids.—Trials throughout the State again showed the superiority of hybrids over open pollinated varieties. Hybrids Tx610 and Brolga were outstanding. The increase in yield, through hybrids, was 25-30 per cent.

Certified Seed Scheme.—There was insufficient hybrid seed to meet all demands and areas registered for hybrid seed production were increased as much as foundation seed supplies would permit. About 600 bushels of Tx610 were produced under the Department's Seed Certification Scheme. The Shand Selected Seed Company of Armidale, in association with DeKalb of U.S.A., produced some 6,000 bushels of hybrids F63A and C45A.

The seed firm of Arthur Yates and Co. Pty. Ltd. became associated with the American seed firm of Northrup King and obtained sorghum breeding material from the latter. This was sown under quarantine with Departmental guidance.

Artificial Drying.—Some interest was taken in artificial drying of sorghum grain. Two landowners installed experimental driers.

Improvement Programme.—A breeding programme with grain sorghum continued at Tamworth Agricultural Research Station. Also, introductions, mainly from U.S.A. sources, were sown under quarantine at Leeton Agricultural Research Station.

Close co-operation was maintained with the Queensland Department of Primary Industries in breeding and in exchange of material.

Difficulty was experienced in building up stocks of male sterile and restorer seed lines, because of isolation requirements, but seed of a large number of lines was produced in limited quantities.

Experimental hybrids using all existing male sterile material were produced for preliminary testing. Preliminary observations of new lines indicated that some new American hybrids would suit most N.S.W. conditions.

In widespread trials the hybrids Tx610, Brolga and Tx650 were superior in yielding ability. This was confirmed by large-scale farmer sowings. Arrangements have been made for Tx650 to be produced commercially.

Investigation indicated little advantage from sowing three-way cross hybrids and that a decrease in vigour and 25-30 per cent reduction in yield occurred by using second generation hybrid sorghum seed. All hybrids again showed a tendency to lodging. Attention has been given to this important factor in the breeding programme. Emphasis has been placed also on earliness in maturity to suit all districts.

Forage Sorghums

Production Trends.—State-wide interest in use of sorghums for fodder again increased. The new hybrid Sudax held most interest.

Sweet sorghum declined a little in popularity in some districts but its use for large-scale grazing in inland districts was maintained. The variety Sugardrip was most popular.

Sorghum almum proved useful as a perennial in some areas, but the area sown declined.

Hybrid Sudax Outstanding in Trials.—In Departmental trials the hybrid Sudax was outstanding in dry matter yield. At Tamworth, Sudax outyielded *Sorghum almum,* sweet sudan S.S.6 and sweet sudan Lahoma by 19.6 per cent, 62.8 per cent, and 80 per cent, respectively; at Moree by 38 per cent, 78 per cent, and 75 per cent, respectively; and at Yanco under irrigation by 34.7 per cent, 20.7 per cent, and 1.3 per cent, respectively. The sweet sorghum variety Sugardrip included in the trial at Yanco was outyielded by 63.3 per cent.

Seed Certification Scheme.—Seed of S.S.6 sweet sudan was produced under the Department's Seed Certification Scheme for the first time. Two growers were registered and produced approximately one ton of certified seed.

Seed certification of sweet sorghum continued; 166 acres were registered under the Department's Seed Certification Scheme, an increase of 15 per cent.

DeKalb (Aust.) Pty. Ltd., in light of Sudax's good trial performance, increased seed production to about 15,000 bushels.

Forage Sorghum Improvement.—The programme continued at Tamworth Agricultural Research Station. Varieties were instroduced from U.S.A., Italy and Argentina. Experimental hybrids were made, using existing male sterile lines. The season was difficult for breeding.

Sudan grass and sweet sorghum experimental hybrids were yield tested. The sweet sorghum hybrid group showed a yield increase over their parental varieties. High yield was associated with early maturity. Early Orange and Sart hybrids again proved superior in total yield to other hybrids tested.

Sudan grass hybrids were tested with their sudan grass parents and results showed their superiority. The later maturing hybrids were favoured during the season, reversing the previous season's experience.

Two Departmental hybrids, A378 x Lahoma and A3048 x Lahoma, yielded significantly higher in trials than the DeKalb hybrid Sudax. Arrangements have been made to name the hybrids Calala and Nemingha, as the first step towards seed production for commercial use.

Broom Millet

Production Trends.—The area sown to broom millet was a little less than in the previous year. Estimated production from the main centres, Lismore, Maitland and Tumut, was 600 tons. Harvesting conditions were better than usual. Fibre was a little shorter than normal, but quality was good. Red stain disease was negligible.

Improvement and Seed Production Work.—A new strain of White Italian millet introduced by the Department again performed well in all districts. It pleased growers and buyers. Increased, selected seed was produced at Bathurst Agricultural Research Station and by co-operating farmers.

Seed of the improved strain was distributed to additional growers; also to broom millet interests in Queensland and the Departments of Agriculture in Victoria and Western Australia.

Fodder and Grain Millets

Production Trends.—The acreage sown to fodder millets was similar to that of previous years. Japanese was the popular variety.

More interest was taken in grain millets, particularly in the Moree-Inverell district. There, about 1,000 acres of Setaria (Hungarian) and 800 acres of White French were grown for the bird-seed trade, almost 100 per cent increase on the previous season.

Improvement and Seed Production Work.—In trials the pearl millets were superior for late grazing. Attempts to produce seed of the pearl millet Katherine were moderately successful.

At Tamworth Agricultural Research Station, pearl millet selection work commenced in 1963 continued. One line was selected for seed increase and testing. This line is of similar maturity to the American hybrid Gahi I and appears equal to it in vigour. The line is quite leafy and, in contrast to other lines, the leaves are non-pubescent.

Vetches

Production Trends.—Vetches again proved valuable throughout the coastal area for high protein supplementary feeding during late winter and the early spring. Acreage increased. Golden Tares occupied 90 per cent of the area sown. Lebanese Tares were used over the remaining areas when sown late.

In Lismore district about 24,000 acres were sown, as against 3,000 acres in 1957; at Kyogle, 3,000 as against 1,000 acres in 1957; and in Murwillumbah district, 6,000 as against 1,000 acres in 1957.

Acreage increase on the mid-North Coast area was not spectacular, but greater interest was shown. The 1963 crop was affected by root rot diseases, which reduced the grazing yields and investigations into the disease factor were intensified. No *Vicia* species tested was disease resistant.

Research and Improvement Work.—Investigational work at Wollongbar Agricultural Research Station indicated that two strains of *Vicia atropurpurea* gave the highest dry matter yield, followed by Golden Tares, *Vicia sativa* CPI15504 and *Vicia sativa* (N.Z.). However, the *Vicia atropurpurea* strains proved highly unpalatable to dairy stock in grazing trials at two centres.

Nodulation problems were found to exist with *Vicia sativa* (Nyabing), and no *Rhizobium* selection for effective nodulation of this strain was located.

At Wollongbar Agricultural Research Station investigations continued into fertilizer and sowing techniques, to reduce farmer sowing costs.

Vetch introductions were made. Testing disease resistances was given highest priority. Arrangements have been made for a pathologist to study vetch diseases more closely in the field.

Extension Demonstrations.—Demonstrations with the vetch crop to extend awareness of its value for winter and early spring grazing were sown at ten centres. These demonstrations increased farmer interest and the acreage sown.

Seed Production Attempts.—Attempts to produce in New South Wales seed of the late types were unsuccessful. Seed of the earlier types were successfully produced in southern New South Wales, at Grong Grong and Wagga Wagga. Tasmania was the main source of seed supply of Golden Tares. This remained the recommended variety.

Cowpeas

Trends.—Interest was maintained. More inland interest was apparent in harvesting of cowpea grain. Inland, about 7,000 acres of cowpeas were harvested for grain. Yields were 6-15 bushels per acre. Some interest was again taken in the export of cowpea grain for use in the meat trade.

The crop provided valuable coastal grazing but extension of acreage for grazing was limited by prevalence of stem and root rot diseases.

Variety Trials.—Variety trials were distributed throughout the coastal area. These indicated that Malabar and, to a lesser extent, Havana, had more resistance than other varieties to root and stem rot. Poona, the variety generally used, proved must susceptible. Caloona, a new variety, developed for disease resistance, was susceptible under north coast conditions.

Seed Production Research.—Investigations into seed production showed Poona to be the most suitable variety and that economic yields are difficult to obtain from the newer varieties Malabar and Havana.

Mung Beans

Mung beans were tested for summer grazing on the north coast. The crop proved a quick grower and resistant to stem rots.

The crop was grown on a small scale for grain production in the north-west, but only light yields were obtained. Investigations in the irrigation districts yielded only light and uneconomic grain yields.

Dolichos Lab Lab

Seed of *Dolichos lab lab* was available in commercial quantities for the first time.

Tested extensively for grazing purposes throughout the coastal area the crop proved excellent and showed its ability to recover after grazing and to grow late into the autumn. It was adjudged superior to cowpeas, particularly because of stem and root rot disease resistance.

Vegetables

GENERAL

Floods in Key Areas.—The report for 1962-63 made mention of an adverse season for vegetable growers because of the prolonged wet weather during the autumn and winter. The year 1963-64 has ended with another disastrous flood in the Nepean/Hawkesbury system and severe flooding at Bathurst. Other coastal and inland streams suffered from floods of lesser intensity. Windsor growers have suffered from floods so frequently in the last fifteen years that many hesitate to resume operations. Vegetables from interstate prevented a serious shortage, though prices rose markedly.

New Research Station, Orange.—Rapid strides were made in developing potato research facilities at the new Agricultural Research Station, Orange. The buildings now erected provide office and minor laboratory accommodation; housing for machinery, tools, agricultural chemicals, seed tuber storage and grading; also a cottage and a glasshouse.

The first potato crop comprised increase-areas of introductions and seedlings from Glen Innes Agricultural Research Station, and clonal selections of popular commercial varieties. The latter are eventually to be released as foundation seed for certified seed growers. An area was made available to the District Entomologist for exploratory work on aphid migrations to the potato crop.

Release of New Varieties.—Release of several new vegetable varieties marked further progress through plant breeding.

Three new tomato hybrids, College Cropwell, College Regal and College Conquest developed at Hawkesbury Agricultural College, were recommended to growers in a ministerial statement in September.

A yellow-fruited capsicum, College Gold, selected also at the College, was named in April. This followed provision of foundation seed to seed firms in the spring of 1963.

A number of fixed lines of peas bred at Hawkesbury Agricultural College and Yanco Agricultural Research Station, particularly suited for processing, have been supplied to processors and seed firms for field trial.

Vegetable Improvement Committee:—In its first year of activity the Vegetable Improvement Committee has co-ordinated the work of plant pathologists and plant breeders. The Committee has functioned largely through sub-committees comprising the plant pathologists and plant breeders interested in the respective crops for which breeding programmes are in progress. The co-operative approach to selection of parents, perfection of testing techniques, assessment of reaction to disease, and similar matters of mutual interest have enhanced the breeding programmes for potatoes, tomatos, beans and rockmelons.

Australian Vegetable Research Conference.—This was held in Brisbane at the end of May. Officers of this Department made substantial contributions to its success by submission of papers for inclusion in the volume of proceedings and by participation in the various debates. Contact with officers from other organisations was a highly valued effect.

POTATOES

Breeding for Improvements.—The potato breeding programme continued at Glen Innes Agricultural Research Station. More than 230 successful crosses were made. These gave almost 1,000 seed balls; a big increase over seed balls actually harvested in the previous season.

In addition to the lines used as female parents in the previous season, extensive use was made of Conchita and Elenita, Mexican lines field resistant to late blight, Norland and Excol from the U.S.A., Fundy and F4724 from Canada, and local seedlings developed from varieties such as B595-76, Menominee, Ontario and Redskin. Male parents used most frequently were numerous locally developed seedlings, Katahdin and Saranac from the U.S.A., and locally produced varieties Exton and Adina.

Approximately 17,000 first year seedlings were glasshouse grown. Promising progenies came from the breeding lines B595-76, Delus, Kennebec and B3429-23 from the U.S.A., Keswick from Canada, and from locally developed varieties and seedlings.

Approximately 4,400 second year seedlings were grown at the substation in single hills, and 445 were selected as worthy of further trial. This was an unusually high selection percentage for second year seedlings, reflecting the improvement resulting from systematic testing and selection of potential parents.

From the 130 third year seedlings grown at the substation, 41 selections were made. Four lines derived from the natural pollinations of Kurrel were very attractive; similar to Kurrel in appearance, shape and quality. Other promising lines were some shallow eyed redskins from the cross (Sebago x 11-79) x Redskin and some well shaped lines from (Emilia x Cherokee) x Exton.

Of 90 fourth year seedlings grown on a co-operating farmer's property, 26 were selected for further trial. The most promising were four lines from the cross B3095-18 x S2856 and three from the cross B3095-18 x Adina. Two lines from the cross Walanga x B2067-52 and two from (Monak x 11-79) x Crana also showed up well.

The preliminary yield trial at Red Range was divided into two sections; early maturing lines and late maturing lines. Of the early maturing types, S 2906, (1563(c)14 x (Monak x 11-79), S 2909, Saco x Adina, and S 2911 (S2821 x Merrimack) showed most promise. In the late maturing section, S 2918 (B595-76 x 336-123), S 2919(B595-76 x Late Katahdin) and S 2920 (Pungo x (1928(e)2 x Cherokee)) were the most outstanding.

Breeding for Disease Resistance.—In respect of late blight *Phytophthora infestans,* several thousand seedlings were inoculated with a spore suspension in the 2-3 leaf stage in the glasshouse. Resistant parents used in these crosses were Avon, Boone, Delus, Kennebec, Plymouth, Pungo, Saco, B595-76 and B3429-23 from the U.S.A., and Keswick from Canada.

Out of 35 advanced seedlings tested by the Division of Science Services Biology Branch during the season, six were found to be immune to the races of blight used. Resistance was derived from Pungo, Tawa, Cherokee and Merrimack from the U.S.A., and 1928(e)2 from Scotland.

In respect of common scab (*Streptomyces scabies*), further testing of first year seedlings for resistance was done by transplanting young seedlings into a blend of sterilised soil and scab inoculated vermiculite. Inoculum was prepared simply by maceration of peelings from scabby tubers in a food blender. Scab resistant progenies were selected from crosses involving Menominee, Haig, Redskin, Ontario, B595-76 and X927-3, all from the U.S.A.

In field tests conducted at Spring Hill on the central tablelands, locally developed seedlings S2901, S2902 and S2904 showed very high resistance when compared with the susceptible controls Sebago and Exton. Of the introductions included in the trial the variety Norland from the U.S.A. showed highest resistance.

In the *Virus X* work, a further batch of 1,800 seedlings derived from such parents as B595-76 and Saco from U.S.A., and 11-79 from the C.S.I.R.O., were tested for resistance.

In the *Virus Y* work, the reactions of seedlings S2869, S2879, S2882, and S2883 were further tested. S2869 proved to be entirely susceptible and has been discarded from further yield trials. The other three seedlings reacted to inoculation with the typical "leaf drop streak" symptoms and would therefore be considered suitable for certification.

Potato Fertilizer Trials.—Further trials were laid down in the series of "Potato Uniform Fertilizer Trials" (P.U.F.T.) designed to compare all combinations of 0, 4, 8, 12 cwt. superphosphate, 0, 1, 2, 3 cwt. sulphate of ammonia, and 0, 2 cwt. sulphate of potash. In higher rainfall areas where response had been obtained from up to 3 cwt. sulphate of ammonia, the trials were varied to include 0, 2, 4, 6 cwt. sulphate of ammonia, and 0, 4 cwt. sulphate of potash. In the Ebor district, a high rainfall area, response was obtained with up to 6 cwt. sulphate of ammonia. Slight responses to potash in the sulphate form were observed in most areas.

The general assessments of fertilizer requirements for potatoes are as follow: Coastal irrigated crops appear to need at least 4 cwt. superphosphate, 4-6 cwt. sulphate of ammonia, and up to 2 cwt. sulphate of potash. In the drier tableland districts the needs appear to be 8 cwt. superphosphate, 2-3 cwt. sulphate of ammonia, and, in most cases, up to 2 cwt. sulphate of potash; some of these areas will respond to up to 4 cwt. sulphate of potash, with higher yield and grade. In the higher rainfall sections of the tablelands, phosphate needs appear mostly to be met by 8 cwt. superphosphate, nitrogen needs by 4-6 cwt. sulphate of ammonia and potash needs by 2-4 cwt. sulphate of potash.

District Variety Trials.—In early maturing trials on the northern tablelands, S2889(B595-76 x Adina), S2890(Sequoia x Cortland), S2893(66-10 x 11-79) and S2897(Redskin natural pollination) were outstanding. So too were selections from the crosses Delus x S2782 and S2821 x Merrimack. In the late maturing section of the trials on the northern tablelands, seedlings S2879, S2882 and S2883, all selections from the cross Monak x 11-79 and from the relatively new variety Kurrel, were excellent. On the central tablelands, local seedlings S2889, S2893 and S2904 gave best results, with Fundy from Canada, and Norgleam from the U.S.A.

Potato Cooking Quality Tests—A further series of cooking tests was co-operatively done by the C.S.I.R.O., on nine varieties and advanced seedlings produced under uniform conditions at Orange. The potatoes in this trial experienced very moist soil conditions late in the growing period. This was reflected in specific gravities and solids contents. These were lower than those in 1962 when the respective ranges were 1.086-1.103 and 20-25 per cent. The slope of the line of best fit to the specific gravity-total solids data was less than usual. It seemed to be due to the solids for S2871, S2872 and Sebago being lower than their specific gravities indicated.

Ranges of flavour and texture scores were similar to those cf 1962. Range of colour scores was wider. The intense yellow of Pinkeye was marked down while Merrimack was distinctly grey. S2864 and S2874 received high colour scores. The former scored best this year with 8.3 points, as against only 6.6 last year.

In general, tasting scores this year were more like those of 1962 than in 1960 and 1961. The 1960 and 1961 quality was consistently high. S2874, Sebago, S2869 and S2864 were similar and best in tasting quality. S2871 and S2872 were acceptable in all aspects; but S2887, Merrimack and Pinkeye had one or more poor tasting scores.

Potato Seed Certification.—The acreage of potatoes submitted for certification this season was much less than in 1962-63. In the 1962-63 season, 1,650 acres were submitted by 146 growers. In 1963-64 only 1,310 acres were submitted, by 114 growers. The number of bags sealed fell from 45,191 in 1962-63 to 36,632 in 1963-64. Of the crops submitted, 16 per cent failed to pass inspection; compared to 22 per cent in the previous season. The virus leaf roll problem experienced last season had decreased.

Production of Elite Seed.—The first crop of "elite" seed of major commercial varieties was produced on the newly acquired Orange Agricultural Research Station. Selected seed was produced of locally developed varieties Bungama, Crana, Exton and Kurrel, and of introduced varieties Sebago, Sequoia, Katahdin and Kennebec. A vigorous programme of spraying with systemic insecticides was followed to ensure no infection with any aphid borne viruses. Aphid counts showed that the spraying programme had been very successful.

Excellent yields were obtained, enabling extensive selections between different lines of each variety. The rogueing programme during the growing season, together with tests for virus content, should ensure very clean seed supplies for the next season.

Potato Introductions.—Of the introductions made in recent years a number were grown at the new Research Station at Orange. The best of these were Fundy from Canada, and Norgleam and Norland from the U.S.A. Most of the lines introduced from Scotland last season were included in the crossing programme; crossed with local seedlings and varieties of known combining ability.

Tomatoes

Breeding Programme.—Tomato breeding programmes were conducted at Hawkesbury Agricultural College and Yanco Agricultural Research Station. At the College, hybrids continued to dominate the trials in terms of yields, resistance to disease and earliness of maturity. However, selections were made from 39 segregating crossbred lines. In addition, seed of two fixed lines have been increased and supplied to seed firms and growers for field testing. These two fixed lines resemble Rouge de Marmande in most respects, but have been endowed with *Fusarium* resistance by crossing with *L. pimpinellifolium* and back crossing to Rouge de Marmande.

At Yanco, the breeding aims to develop *Fusarium* resistant dwarf varieties suitable for processing. Some attention is being given to evolution of compact bushes with concentrated maturity. These would be of value if mechanical harvesting be adopted.

For *Fusarium* resistant dwarf varieties, combinations of Roma, Red Top, KYI, Bounty, Kokomo, Pan America, Moscow and No. 255 in advanced generations have produced selections showing high *Fusarium* resistance combined with good field characteristics.

Breeding lines from California, and Epoch, Libby 52 and H1370 from the U.S.A. have been crossed with YTMF8, bred at Yanco, to evolve compact bush types.

Three Hybrids Named and Released.—After several years of outstanding performance in trials three hybrids, College Regal, College Conquest and College Cropwell were recommended to coastal growers. The respective female parent was Step 286, Anahu and Indian River, and Rouge de Marmande was the male. All are suited to early coastal production and able to set under quite cold conditions. They are tall varieties, and can be staked or trellised. College Conquest gives some indication of eelworm resistance, yet to be confirmed in the field.

Variety Trials.—Varietal suitability for mechanical harvesting was under evaluation at Yanco Agricultural Research Station.

Three times of picking, three rates of nitrogenous side dressing (including Nil), and four plant spacings, were used. All varieties gave the highest yield four weeks from the commencement of ripening. Four of the five gave highest yield from closest spacing, namely 6 inches. Four of the five responded to side dressing.

In field trials at five localities in the M.I.A., YTMF8 ch. a dwarf variety similar to the commonly grown commercial variety KYI but having *Fusarium* resistance, produced particularly heavy yields—due largely to freedom from disease.

Tests with Irradiated Seed.—Seed irradiated with radioactive phosphorus reached the R_2 and R_3 generation, respectively the 2nd and 3rd generation after irradiation. Main object of the treatment is to determine whether male sterility, desirable for the production of hybrids, may be induced. Of 860 plants comprising 43 different lines, 11 have shown some promise of genetic male sterility. One fertile line of the true Grosse Lisse type showed tolerance to *Alternaria* blight, combined with high yield; while two plants were earlier and more prolific than Grosse Lisse.

Introductions.—Of the indeterminate varieties grown at the College, Floralou, Porter's Pride and Hotset from the U.S.A., and Vogue from Canada, were the most promising. At Yanco Agricultural Research Station, H1370 and Porte from the U.S.A. appeared the most useful dwarf types, but are susceptible to *Fusarium* and unlikely to find a place commercially. Floralou and Rockingham from the U.S.A. appeared useful tall varieties.

FRENCH BEANS

Breeding Programme.—At Hawkesbury Agricultural College the season permitted selections from crossbred lines. The 97 selections made from the spring crop were resown in the autumn, then further selected. Anthracnose-resistant and rust-tolerant selections of both stringed and stringless types are now in advanced generations.

At Yanco Agricultural Research Station the programme comprised further selection of dwarf varieties developed from the pole variety Blue Lake FM-1. The object is to incorporate the high pod quality of Blue Lake into a dwarf variety. Nine fixed crossbreds having Processor or Seminole as the second parent have been selected. They are of good field type and produce a stringless pod with white seeds. They are also resistant to the virulent root rot complex which has seriously troubled stringless beans in western districts in recent years. Blue Lake, apparently immune to the trouble, appears to have conferred a high degree of resistance to the progeny. Sufficient seed has been produced for field trials in disease-liable districts.

Introductions.—Of the introduced varieties, Spartan Arrow from U.S.A. and two unnamed crossbreds from Queensland showed most promise; the former at Hawkesbury Agricultural College and Yanco Agricultural Research Station, and the latter at the College only.

The Root Rot Complex.—In association with Division of Science Services Biology Branch, also seed firms and processors, replicated trials of many varieties and strains of stringless beans were undertaken in three localities. The object is to find out more about a root rot wherein several disease organisms seem to be associated. Pathological tests are still being undertaken on infected specimens from each trial. Some clarification of strain susceptibility to the complex is occurring.

Manganese Trails.—Stunting of bean crops on old cropping land in the Murwillumbah district led to leaf analyses. The analyses indicated manganese toxicity, perhaps due to the acid soil conditions developed through continued use of sulphate of ammonia.

A preliminary trial of various rates and types of lime, to counteract the acidity, was undertaken at Terranora Vegetable Station. The liming increased yields on old bean land. A more comprehensive trial has been established in co-operation with Division of Science Services Chemistry Branch.

Seed Certification.—Farmer interest in production of certified seed further declined; 51 acres were submitted for certification, compared to 83 in the previous year; 32 acres were certified, compared to 38 in 1962-63; 181 bushels have been sealed.

PEAS

Breeding Programme.—At Hawkesbury Agricultural College four fixed crosses from Early Wonder x Canners 75 and one from Early Wonder x Greenfeast have shown a lot of promise as processing varieties. Seed has been supplied to processors and seed firms for observational trials.

At Yanco Agricultural Research Station two varieties developed from the cross Greenfeast x Clucas Early Dwarf and one from the cross Greenfeast x Massey have been included in replicated trials and subjected to trial canning for two years. They have shown consistent early and concentrated maturity, good canning quality, and the smallness favoured for quick freezing. Their yields have been quite good for quick maturing varieties. Seed of these three fixed lines have been supplied to processors and seed firms for field trial.

ROCKMELONS

Breeding Programme.—Pleasing progress has been made in breeding for combined powdery mildew and *Fusarium* wilt resistance. Resistance to *Fusarium* has been sought from Spartan Rock, Edisto and several breeding lines including oriental melons. The breeding lines are the only source of resistance to the strains of powdery mildew present in the M.I.A.

Almost 6,000 seedlings were screened in the glasshouse for both diseases. The survivors were transplanted into the field, where selected lines were self fertilised. Almost 30 selections were made. Of these, almost half were in the F_4 generation and were developed from the cross (36739 x PMR No 45) x PMR No. 45; 36739 being an oriental breeding line quite different to commercial melons, and PMR No. 45 being one of the most popular commercial varieties.

In a search for new resistant parents, 14 varieties were screened for resistance to *Fusarium* and mildew. A number of plants showing combined resistance to both diseases were obtained from several breeding lines, and from PMR 88, Florigold, Wescan, and Seminole—all introduced from U.S.A.

District Trails of Selections.—In observation plots at Griffith, five selections from the cross PMR No. 45 x Spartan Rock in the F5 generation showed complete resistance to *Fusarium*. This was in a field where the variety PMR No. 45 had to be twice sown because of very high loss of seedlings to *Fusarium* wilt.

CAPSICUM

Breeding.—One result of a minor breeding programme with sweet peppers is a new variety with attractive yellow fruit. It was named College Gold and has been released to the public. Seed firms had previously been supplied with foundation seed. At full maturity, College Gold develops an intense shiny redness like popular commercial varieties.

Tests by the C.S.I.R.O. Division of Food Preservation showed that College Gold was richer as a source of vitamin C than are the green types at all stages of maturity. Quick frozen, the capsicum when prepared for use after months of storage resembled the fresh material more closely than any other fruit or vegetable product that has been handled by the Division of Food Preservation.

ONIONS

Transfer of the agronomist handling vegetable crops at Bathurst Agricultural Research Station has forced the hybrid breeding programme to be held in abeyance. This programme will eventually be transferred to the new Agricultural Research Station, Orange.

CAULIFLOWERS, BRUSSELS SPROUTS AND BROCCOLI

As with hybrid onions, the breeding programmes with these crops also have been held in abeyance pending possible transfer to the Agricultural Research Station, Orange.

At Glen Innes Agricultural Research Station comprehensive trials of cauliflowers, Brussels sprouts and sprouting broccoli were undertaken to determine whether these crops offered possbilities for commercial quick freezing in the local freeze plant. The crops grown under irrigation on typical black self-mulching soil were an outstanding success. The frozen product was equal or superior to corresponding interstate products.

ASPARAGUS

The Division of Plant Industry is represented in the Planning Committee directing activities of a research agronomist employed by the Gundagai Asparagus Company. In the first year of operation the asparagus research programme has derived useful results on the use of herbicides and eradication of asparagus. Trials aimed at improving the strain of asparagus, especially in disease resistance, have been started. Rotation trials and fertilizer trials have also been established.

DIVISION OF HORTICULTURE

Research for the Fruit Industries

RESEARCH—CITRUS INDUSTRIES

Fruit Fly.—(*a*) *Sterilization of Oranges*: Following four satisfactory trial shipments, fumigation of oranges with ethylene dibromide after waxing, wrapping and packing has been accepted by New Zealand and by the Philippines and Fiji. Oranges may now be exported to these countries from the Murrumbidgee Irrigation Area and from coastal districts. South Australia, Victoria and Tasmania have also accepted this treatment. Its purpose having been satisfied the Technical Committee for investigation of sterilization of oranges for fruit fly has accordingly been terminated.

(*b*) *Sterilization of Lemons, Mandarins, and Grapefruit*: At the Citrus Wastage Research Laboratory, Gosford, work on ethylene dibromide fumigation treatment of lemons, mandarins and grapefruit continued—under the general direction of the Fruit Fly Commodity Treatment Committee. The progress results indicate satisfactory uptake of ethylene dibromide by lemons, mandarins and grapefruit, but rind injury assessments have been inconclusive and are continuing.

Mould Wastage.—Four chemicals impregnated into paper wraps were tested at the Citrus Wastage Research Laboratory, Gosford, in comparison with diphenyl for use as volatile fungicides against green mould in oranges. These materials were dibromotetrachloroethane and three esters of orthophenylphenol. Mould control was effective but rind injury assessments have yet to be concluded.

Black Spot.—The Citrus Wastage Research Laboratory has been evaluating treatments designed to prevent expression of Black Spot on the rind of oranges after harvest. Fruit in sealed polythene bags where an atmosphere of high carbon dioxide and low oxygen levels was developed, showed some Black Spot prevention. A wax treatment and a treatment involving coating with a particular non-ionic detergent also showed some promise.

Puffing and Creasing.—This condition, indented lines in the fruit rind sited over break lines in the pith or albedo, causes extensive down-grading and in some cases rejection of oranges and mandarins submitted for packing. The problem is under investigation at Yanco Agricultural Research Station.

Mandarin Thinning.—Some mandarin varieties, the popular Emperor in particular, are prone to overcrop and develop a scald condition which puts the trees out of production for a year or two. A crop-thinning trial, using a chemical spray has been commenced at Ebenezer. Results have been clouded by high Brown Spot incidence. Further work will be done.

Lemon Rootstock trials—Griffith.—The value of a nucellar Eureka lemon—the Lambert—is being assessed under M.I.A. conditions, with irrigation by overhead spray. Reactions and performances of eleven rootstocks are being assessed. This trial was planted in 1960 and positive assessments are not yet feasible. Progress observations are as follow: trees on Yuzu rootstock have little vigour; those on Emperor mandarin, Scarlet mandarin and Cleopatra mandarin stocks are making promising headway and more than those on Seville stock.

Lemon and Mandarin Variety Introductions.—Budwood of the nucellar Lisbon varieties of lemon, Prior and Munro, together with budwood of Minneola Tangelo and Clementine (Algerian) Mandarin, were obtained this year from California. The buds are propagated in quarantine at Rydalmere and the propagations have since been released from quarantine. These will be grown at the Horticultural Research Station, Narara. The Prior and Munro Lisbon lemons are nucellar strains widely grown in California and have reputations for vigour and production.

The Clementine Mandarin and Minneola Tangelo are virus-free strains introduced because local strains were all carrying virus infection.

Citron Introduction.—The Etrog Citron was introduced on advice from California, for test as an indicator plant for early detection of Exocortis (Scaly Butt) virus.

RESEARCH—STONE FRUIT INDUSTRIES

Variety Trials.—Many of the great number of canning and dessert peaches introduced from interstate and overseas sources in recent years are now well established in trial plots at the Bathurst and Yanco Agricultural Research Stations. A few have reached the early fruiting stage. Others are still in post-entry quarantine. Some new apricot and plum varieties are also under observation.

Improved handling, dessert and processing qualities can be expected as a result of this work. Already there are indications that some of the new varieties are much better than those now being grown commercially.

Breeding.—The breeding programme with canning and dessert peaches and apricots is at Yanco Agricultural Research Station. Some very promising selections are at an advanced stage of testing. In particular, an apricot selection named Morocco compares more than favourably with the current commonly grown canning variety.

Chemical Thinning.—The aim is to replace the costly time-consuming operation of hand thinning. Tests have been conducted over several seasons using a number of materials. These include Dicryl, NPA, 3CP and DNBP on peaches, plums and prunes. So far, only DNBP has shown any promise. Wilson plums on the coast have been successfully thinned with DNBP. This material also showed promise in a small test with canning peaches. The work is continuing.

Rootstocks Research.—Multiplication of European plum stock material has been advanced, sufficient for propagation of peaches for inclusion in rootstock trials. The aim is to assess the value of plum rootstocks, for dessert and canning peaches, as means of avoiding tree losses which occur with peach seedling rootstocks in wet soil conditions. The plum rootstocks being used are reputed to be compatible with peach and more resistant to excessively wet conditions.

One of the nematode-resistant peaches introduced several years ago has produced seed, and a number of trees have now been planted at Narara Horticultural Research Station for resistance tests. If nematode-resistance is proved, commercial varieties of peaches will be worked on these stocks and distributed to trial plots where nematodes are a problem.

Apricot Breakdown.—This condition occurring in fruit after canning has caused much concern in some seasons. Investigations have been proceeding at Yanco Agricultural Research Station. A lead into the mechanism of the disorder has now been obtained, and suitable control measures are expected soon.

STRAWBERRY RESEARCH

Strawberry Improvements.—A large number of overseas strawberry varieties continued under trial. Also, several promising seedling selections from the Department's own breeding programme were further tested. As a result, the variety Climax has been recommended for inland plantings.

Since the 1961 release of Kendall, developed by the Department for coastal plantings, the outlook for strawberries as a profitable crop has improved considerably. Plantings are notably increasing. At least 80 per cent of all plantings in coastal districts now comprise Kendall.

Another seedling strawberry of outstanding promise is undergoing final tests in various districts.

RESEARCH—GRAPE INDUSTRIES

Doradillo Decline.—Results of a pruning experiment commenced at Griffith in 1960 have confirmed earlier observations that widespread decline of Doradillo wine grapes is not associated with overcropping. Regardless of pruning methods, a four-year cycle is apparent; two years of low yield alternating with two years of high yield. This cycle also showed up in Doradillo production figures recorded for the district over the past twelve years.

In low crop years, yield increased as severity of pruning treatments decreased. In high crop years, the yields of vines pruned in a range of 16 x 1 bud spurs to 20 x 2 bud spurs were similar and not closely related to severity of pruning. Vines pruned to 16 x 2 bud spurs + 4 rods (lightest pruning) had the lowest yield in high years.

In all treatments except rod pruned treatment there was relationship between pruning weights and yield the following summer. This could provide crop prediction.

Flaccidity of Purple Cornichon Table Grapes.—Occurrence of poorly-coloured and flaccid berries in Purple Cornichon table grapes is causing considerable economic loss in the M.I.A. Research has been continued. Reduction of berries per bunch, by hand thinning just after set, greatly improved colour and firmness of the berries; the more berries removed, the greater the effect. Removal of the lower half of the bunch, just after set, shows promise as a commercial means to overcome the problem.

Zinc Foliar Sprays and Fruit Set.—At Griffith, zinc sulphate and lime and zinc chelate sprays at about full-bloom gave no marked increase in berry set. In contrast, in earlier work there had been marked improvement in berry set following a spray of zinc sulphate and lime applied four days before full bloom. In the Lower Murray district assistance to the C.S.I.R.O. continued in trials to test the effect of zinc sprays on sultana yields.

Weed Control in Newly Planted Vines.—At Griffith Viticultural Research Station the effects of different weed control methods on newly planted Cornichon vines were compared. Simazine, a pre-emergent herbicide applied at 4 lb. per acre, severely damaged the vines. The vines made no better growth than the unchipped control vines. Vines chipped three and four times during the growing season made twice the growth of the unchipped controls.

Variety Improvements.—Fifteen wine grape varieties have been recently introduced into the M.I.A. These are being propagated for variety trials to be planted at the Griffith Viticultural Research Station. They include introductions from Europe, South Australia and the Hunter Valley. Their performances elsewhere suggest considerable promise for improving the quality and the range of M.I.A. wines.

Rootstock Trial for Table Grapes.—In a trial commenced at Orchard Hills in 1958 to test eight *Phylloxera*-resistant rootstocks for Black Muscat table grapes, the 106.8 variety continued to be the most productive. It averaged 18.2 lb. of fruit per vine during the 1963-64 season. As in previous seasons, then followed vines on their own roots, 14.1 lb. per vine. Du Lot, the most popular rootstock in the district, yielded 13.4 lb. per vine, improving to third position. By far the most vigorous vines as judged by pruning weights are those on 62.66 rootstocks, but they yielded only 11.2 lb. per vine in 1963-64.

RESEARCH—POME FRUIT INDUSTRIES

Apple and Pear Rootstock Trials.—An apple rootstock trial at Glen Innes Agricultural Research Station incorporates the varieties Granny Smith, Jonathan and Delicious, on a full range of Malling-Merton clonal stocks. At the same station there is a pear rootstock trial to test the influence of various intermediate pear stem pieces on Packham's Triumph, with D6 as the rootstock.

At Yanco Agricultural Research Station, sixteen rootstocks are being compared for the variety Granny Smith. Some are of local origin and the rest are clonal selections from overseas.

All of the trials are progressing satisfactorily.

Apple Variety Trials.—Under trial at Bathurst Agricultural Research Station are fifteen new apple seedlings of local origin, six strains of Red Gravenstein, three strains of McIntosh Red, and five imported varieties. Some of the seedlings show definite promise and their fruit are at present undergoing further storage tests. One of the imported varieties, Starkrimson, has already been fairly extensively planted at Batlow and Orange and on the New England tablelands.

Several imported varieties from New Zealand are at present in quarantine at Canberra pending release to the collection.

Bumpiness of WBC Pears.—At Yanco Agricultural Research Station parthenocarpic setting of Williams pears by means of the growth substance 2,4-D shows promise of overcoming the canners' objection to the shape of this pear as grown in the M.I.A.; also greater yield.

Cold Storage Sterilization of Pears for Fruit Fly.—A probit line was established for the exposure time-mortality relationship for Queensland fruit fly in pears held at 32 ± 1° F. Hope is held that this work will lead to U.S.A. quarantine authorities' acceptance of pears from Australia.

RESEARCH—TROPICAL FRUIT INDUSTRIES

Post-harvest Handling of Bananas.—These investigations are at the Tropical Fruit Research Station, Alstonville, under the aegis of the Banana Research Advisory Committee.

For the mixed-ripe problem, work has been commenced on the roles of fruit size, position on bunch, stage of fullness, and time of bunch emergence.

Methods to assess fruit damage relationships with packaging have been examined.

Preliminary work has been done on cooling and on low temperature effects on the fruit.

Soil-Banana Plant-Water Relations.—Prior to establishment of an irrigation trial at the Alstonville Station preliminary work has been done on banana root distribution, soil moisture measurement techniques, and soil survey and profile studies.

Banana Nutrition Trial.—First bunches will shortly be cut from the banana nutrition trial at Alstonville Station. The trial, planted in 1962, is comparing three levels each of nitrogen, phosphate and potash.

Pineapple Selection Programme.—With a view to selecting a clone suitable for New South Wales conditions and for canning purposes, pineapple selections are being assessed for physical and chemical characteristics of the fruit and for agronomic characters.

Variety Tests.—Variety collections for observations on performance have been increased at Alstonville Tropical Fruit Research Station. The collections include pineapples, Macadamia nuts, pawpaws, avocados, mangoes, passionfruit, custard apples, and litchi nuts.

FRUIT STORAGE INVESTIGATIONS

These investigations are at Ryde in co-operation with the C.S.I.R.O. Division of Food Preservation.

Controlled Atmosphere Storage.—Effects of carbon dioxide and oxygen concentrations on internal breakdown of Jonathan apples have been studied. Rates of ventilation and of weight loss were also measured, since they may have an effect.

As reduction of humidity around the fruit by calcium chloride produced significant effects on wastage of apples in polyethylene-lined boxes, calcium chloride is being applied during the 1964 season to fruit stored in controlled atmospheres.

Use of Polyethylene Bags.—(*a*) *Apples*: Now that use of ethoxyquin to inhibit scald has been approved, storage of the Granny Smith variety in sealed 1½-mil. bags can be recommended. Use of large film bag liners in bulk bins with the Jonathan variety is currently being studied.

(*b*) *Pears*: To avoid brown heart the use of sealed bags is limited to such varieties, as Packhams, as can tolerate at least five per cent carbon dioxide.

In a trial with Winter Cole pears, absorption of the carbon dioxide with lime for various initial periods increased the final development of brown heart. But when the carbon dioxide was kept to near zero throughout, no brown heart developed. Work with CO_2 absorbents is continuing.

Some preliminary work with large polyethylene bag liners in bulk bins is in progress at Batlow.

Control of Superficial Scald with Diphenylamine and Ethoxyquin.—No further storage work has been done, but some residue data have been obtained for ethoxyquin residues after storage. These were all within the tolerance of 3 ppm. Control of superficial scald on Packham's Triumph pears by means of oil wraps, diphenylamine and ethoxyquin, as reported in 1962, has been confirmed by workers in Western Australia, New Zealand, and South Africa.

Nutrition in Relation to Fruit Storage Quality.—An experiment with three levels of nitrogen, phosphorus and potassium injected as solid chemicals directly into holes in the trunks of trees has been started with Jonathan apples at Bathurst Agricultural Research Station. No significant tree injury has occurred. Samples of fruit from the treated trees have been placed in cool storage, for assessment of keeping quality.

Maturity Studies with Bananas.—Work has been done towards developing a suitable index of maturity whilst the fruit is still hard-green. Attention has been directed to changes in leucoanthocyanins. A satisfactory method for their estimation has been developed. It has been shown that leucoanthocyanin content drops substantially before any appreciable rise in respiration, as measured by CO_2 output, is detected.

RESEARCH STATIONS AND LABORATORIES

Tropical Fruit Research Station, Alstonville.—The research staff has been increased to three, with two officers appointed this year to undertake the post-harvest and plant-soil moisture studies.

Further steps towards irrigation for the Station include selection of a pumping site on Maguire's Creek, survey of the line for the rising main, and test borings at the reservoir site.

Agricultural Research Station, Bathurst.—Re-organisation at Bathurst is now well advanced. Facilities have been gradually improved for pursuance of intensified research. New office accommodation, laboratory space and a records room have been provided. Water reticulation piping has been further extended to the orchard and nursery. Fencing of re-adjusted boundaries has been almost completed.

Agricultural Research Station, Glen Innes.—All the old pome fruit trials have now been terminated and the trees removed. The land thus made available is now being re-conditioned, for pending dwarf apple and hedgerow planting trials.

A new strawberry varieties trial has been established to further assess their value under tableland conditions.

Agricultural Research Station, Yanco.—Initial plantings of a detailed trial to compare various dwarf selections of citrus were made.

Peach variety trials produced satisfactory crops. Several new varieties were recorded for the first time. Fruits of most peach varieties were canned for future, quality assessments.

Irrigation trials are an important facet of the Station's operations. These include work on both spray and furrow irrigation.

Viticultural Research Station, Griffith.—A major addition to the research activities has been the 1963 planting of an experiment area of four acres to investigate the effect of varying irrigation programmes on the yield and quality of Black Shiraz wine grapes. Also, an acre of Purple Cornichon table grapes was planted for short-term experiments.

Preparatory work for a variety trials area, including installation of irrigation facilities, re-grading and leaching, is nearing completion. Plantings will commence in 1965.

Major improvements to research facilities were completed; construction of a new laboratory and packing shed, and purchase of a new fruit grader and scientific equipment including a spectrophotometer and flame photometer.

Horticultural Research Station, Dareton.—Installation of spray irrigation facilities on a four acre block is proceeding, to permit the first experimental grape plantings during 1964. The initial experiment will test the productivity of six high yielding sultana selections and at the same time permit short-term experiments to be superimposed.

New grading equipment, with photo-electric cell counters, was installed in the packing shed.

Horticultural Research Station, Narara.—This is the major centre for the work of the Department's Citrus Improvement Committee, with plantings on both lowland and highland sections of the Station. Another important feature is the strawberry programme, comprising introductions and breeding.

Recent improvements include a new research glasshouse.

Citrus Wastage Research Laboratory, Gosford.—Operated co-operatively with the C.S.I.R.O. Division of Food Preservation, the Gosford laboratory is the centre of fruit fly commodity treatment investigations, as well as work on citrus preservation and storage. Renovations and additions to the laboratory have been completed and a new washing, sterilizing and waxing plant designed for investigational work is now operating.

Cool Storage Laboratories, Ryde.—Fruit storage investigations are conducted at Ryde co-operatively with the C.S.I.R.O. Division of Food Preservation. The programme includes studies of the effects of storage temperature and humidity on the storage life of fruits, control of superficial scald with diphenylamine and ethoxyquin, use of polythene bags for storage of apples and pears, control of wastage in cool stored grapes, nutrition in relation to apple fruit storage quality, controlled atmosphere storage, and banana maturity studies.

Committee Affecting Research

Co-ordination of Research in Fruit and Vegetable Processing.—The Committee, comprising representatives of the C.S.I.R.O. Division of Food Preservation and this Department, with two representatives from the canning industry, met twice this year. The Committee co-ordinates research on fruit and vegetable processing in N.S.W., reviews progress of investigations, and plans future work. Matters under attention this year included breakdown of apricots, maturity testing and dipping of prunes, and strawberry freezing.

Deciduous Fruit Tree Improvement Committee.—The Committee, comprising officers of the Division of Horticulture and the Division of Science Services Biology Branch, aims—by selection of propagatory material—to prevent the spread of virus diseases. Working in close co-operation with the N.S.W. Nurserymen's Association, the Committee has been able to ensure that most deciduous trees in N.S.W. are propagated from approved parent sources. Though selection so far has been based only on apparent visual freedom from virus diseases, considerable progress is being made towards building up sources of proven virus-free material. A collection of virus indexing plants has been established. Testing of cherry varieties has been commenced.

Commonwealth Dried Fruits Processing Committee.—At a meeting in Adelaide in November, 1963, the Committee agreed that arrangements be made for publication of its extension bulletin on drying of vine fruits by the C.S.I.R.O. Agricultural Research Liaison Section.

Reports were received on current research into sulphuring of tree fruits, maturity indices for prunes, paraffin substitutes and moisture meters for dried vine fruits. Considerable progress had been made in all these fields of investigations. Sun-drying of sultanas and removal of green-tinge were discussed and it was agreed that further research into these matters was warranted.

Co-ordination of Fruit and Vegetable Storage Research.—This Committee held its biennial meeting at Ballina, following the Conference of Fruit and Vegetable Storage Investigators organised by the Committee. Representatives at both the Conference and the Committee meeting were from the Department of Primary Industry, the C.S.I.R.O., all state Departments of Agriculture and New Zealand.

The Murray Citrus Sub-committee met in Sydney to discuss results of the co-ordinated programmes of citrus handling and storage investigations in N.S.W., South Australia and Victoria.

Advisory Committee on Fruit Cool Storage Investigations in N.S.W.—Physiological, biochemical and chemical aspects of fruit storage were reviewed at this Committee's meeting, attended by representatives of the University of Sydney, the C.S.I.R.O., and this Department.

Citrus Wastage Research Committee.—This sub-committee of the Advisory Committee on Fruit Cool Storage Investigation in N.S.W. met twice during the year, to direct research by the Citrus Wastage Research Laboratory at Gosford into the causes and control of post harvest wastage in citrus fruits.

Fruit Fly Sterilization Investigations in Citrus.—The Technical Committee comprising representatives of the Department of Primary Industry, the C.S.I.R.O., and the State Departments of Agriculture in Victoria, South Australia and N.S.W., met once this year. This Committee was formed in 1955 to direct investigations into the sterilization of oranges for fruit fly; aimed at providing a treatment acceptable to importing countries, so that export trade could proceed should fruit fly appear within the quarantine radius of 50 miles of any producer centre. This objective has been achieved. During the year New Zealand and other countries accepted the ethylene dibromide (EDB) fumigation treatment of waxed, wrapped and packed oranges. Thus, this Committee was terminated as at 30th June, 1964.

Fruit Fly Commodity Treatment Committee.—This Committee has similar representation to the Technical Committee except that the Queensland Department of Primary Industries is also represented. It directs investigations into sterilization of lemons, mandarins, grapefruit and pome fruit for fruit fly. This Committee met once this year. The citrus work is programmed to end at 30th June, 1965.

The work with pears was programmed to end at 30th June, 1964. Aimed at satisfying United States quarantine requirements, seemingly appropriate data were obtained but the U.S.A. authorities have requested more. A further year of work will be needed.

N.S.W. Citrus Juice Quality Investigation Committee.—This Committee was formed during the year, with representation from the C.S.I.R.O., the M.I.A. Irrigation Research and Extension Committee, the Citrus Growers' Council, and the N.S.W. Department of Agriculture. The aim is to direct investigations into citrus juice quality variations in relation to district, rootstock and scion strain influences. Two meetings were held this year and work on Navel and Valencia oranges has been undertaken. Particular use is being made of fruit from Departmental stock and variety trials located at Narara Horticultural Research Station and Yanco Agricultural Research Station.

Citrus Improvement Committee.—This is an intra-Departmental Committee concerned with virus influences on tree health, rootstock performance, and scion-rootstock relationships. Three meetings were held this year; reviewing projects, assessing results and preparing a programme of work for the coming year. Special interests are the performance of Etrog Citron as an indicator for exocortis virus, the transmission characters of dwarfing clones, and the grapefruit protection value of mild strain "stem pit" against severe strain "stem pit" infection.

Banana Research Advisory Committee.—This Committee, established by the Standing Committee on Agriculture, met twice this year. The Committee recommends allocations of the funds contributed by the Australian banana industry and the Commonwealth Government and an investigational programme on post-harvest banana handling problems. Results of the Committee's activities include location of another research officer and considerable new equipment at Alstonville Tropical Fruit Research Station.

Extension Activities in Fruit Districts

Range of Services.—The demands from individuals, grower organisations and industry groups for services of the Division continued to increase.

Press, radio, television, demonstrations, field days and group meetings were increasingly employed. Rural television, which became available to two regions this year, has opened a new channel of communication. It has proved to be highly satisfactory, but very demanding of field officer's time and effort.

Staff and Training.—Fruit officers attended schools in Extension Methods and Farm Management. Junior fruit officers, in training at Research Stations, gained district experience by association with District fruit officers. An In-Service Training School was organised for approximately half the regulatory staff, for instruction in extension methods and in conduct of regulatory and court duties. A similar School will be held later in 1964 for the other half of the regulatory staff.

Packing and Presentation of Fruit.—The special State-wide campaign for improved grading and presentation practices continued, with increasing success.

The fruit packing instructor, in co-operation with District officers, conducted two Apple Packing Classes on the Northern Tablelands. The classes yielded 67 proficient packers. Demonstrations and addresses were provided in all districts, affecting stone fruit, pome fruit, citrus, bananas and tomatoes. The campaign's effect is well reflected at the Sydney market.

Pruning.—A lot of attention has been given to this. Particularly good results have been apparent in the improved handling of Williams pear trees in the Murrumbidgee Irrigation Areas and of vigorous young stone fruit trees in all districts.

Orchard Drainage.—Interest in underground drainage has been maintained in the M.I.A. and the Gosford district in particular and has made heavy demands on extension officers. Growers of dried vine fruits in the Murray River irrigation districts were especially helped in rehabilitation of old plantings. These were becoming uneconomic, because of salting and seepage caused by faulty drainage and surface drainage designs.

Citrus Processing.—With increased adoption of the washing, rinsing, waxing and drying processes for citrus fruits, using special fungicidal treatments, considerable extension work in all citrus districts has been concerned with advice on plant, layout, and operation of washing units.

Fruit Industry Trends

Pome Fruit Industry Trends

Production.—Production last season was in the vicinity of 3,000,000 cases of apples and 650,000 cases of pears. It is obvious from the following acreage figures that steady increase in production will continue for years.

Plantings.—The present apple and pear acreage in New South Wales is 22,356. Of this total 7,253 acres are under 10 years old and either non-bearing or only in the early bearing stage.

New commercial planting has eased down but is still active—particularly in areas close to Sydney where city people continue to acquire small areas of land and plant fruit trees.

A large proportion of new commercial plantings in the main highland districts is on the "hedgerow" system, with 12 ft. x 24 ft or 11 ft. x 22 ft. spacing, using Northern Spy rootstock.

Varieties.—In the major districts new planting of apples is restricted to storage varieties—mainly Starkrimson, Crofton and Bonser.

In the M.I.A. and at Forbes little but Granny Smith is being planted. The population of young trees of this variety in both places is such that the New South Wales export quota will soon need re-adjustment.

In the early districts continuing low prices for early apples has caused some growers to re-work or destroy blocks of McIntosh Red and Gravenstein.

Prices.—Prices on the whole improved as compared to the previous year's. This reflects growers' increasing awareness that low grade fruit is not wanted by the markets in the face of the large quantities now available.

Export.—This season has revealed growers' increased interest in overseas export. Early in the season there appeared likely to be far more fruit available for export than was allowed for in New South Wales export quota. However, hailstorms in the Kentucky, Batlow and Oakdale areas precluded these areas from forwarding more than token quantities and, as the crop in the M.I.A. was a little below normal, the quota for U.K. and Europe has not been reached.

New South Wales fruit has been well received on the overseas markets this year and prices have been reasonably good. As N.S.W. production increases growers will look to export outlets far more than in the past.

Processing.—Greater interest is being taken by the industry in securing for pome fruits outlets other than the fresh fruit market. District organisations are trying to ascertain whether otherwise reject apples can be satisfactorily channelled into useful by-products. This season three processors have shown a practical interest by purchasing low grade fruit for pulping and juice. Batlow Packing House is installing up-to-date machinery to improve the quality of juice products.

Cool Storage.—Interest in Cool Storage continued high. At Orange and Bathurst there are now 86 cool stores, with aggregate capacity of 1,156,000 cases. During the next 12 months space for at least another 100,000 cases will be added. At Batlow and on the New England tablelands also, new stores and additions to existing stores are projected for next season. These will increase the State's storage capacity used primarily for fruit storage to well over 2,000,000 cases. Most stores now being built are designed with a view to storage of bulk bins.

Bulk Handling.—Advantages of bulk harvesting methods continue to interest growers. At Batlow and Orange almost half the crop is now handled in bulk. In other districts, also, a substantial proportion of the crop is bulk handled.

Stone Fruit Industry Trends

Production in General.—Crops generally were heavy and of high quality. Some yields were adversely affected by earlier rain. Apricot crops were below average. Heavy losses of late cherries occurred at Orange. Dessert and canning peaches, and prunes, yielded well above average.

Canning Peach Production.—Though rate of planting notably declined this year, the high proportion of 1-5 year old trees (34 per cent) to come into bearing will increasingly swell production for the next few years.

There is a strong move in the M.I.A. towards enlargement of cannery capacity to handle increased peach production.

The small plantings of canning peaches in Lower Murray areas are not proving very successful, because of production and marketing difficulties. The trend there is towards removal of trees.

New Peach Varieties Create Interest.—Some of the imported dessert peach varieties recently released have captured great interest in all districts. Already the trend is to plant them in preference to older varieties, particularly for early production.

Plum and Peach Plantings.—New plantings of Japanese plums have been noted, particularly in coastal districts, but for the State as a whole the position is fairly static. The dessert peach position is similar, with increases in coastal and some tableland districts. Generally, total plantings have been a little less than in the previous year.

Cherry Planting Continues at Young.—With increases in plantings, the cherry acreage at Young is now approaching 2,900. About 50 per cent is non-bearing as yet. In the past ten years production has increased from 75,000 to 290,000 x ½ bushel cases per year. It will be much higher later.

Increased Use of Cold Stores.—Cool stores are now more prominent in post harvest management of stone fruits, mainly to reduce fruit temperatures in an effort to market a more acceptable product.

Prices.—Prices for cherries were generally excellent both on the fresh fruit markets and at canneries.

Sales of prunes slumped badly during the latter part of the year and most packers had a substantial carry over from the previous crop. This industry is moving towards establishment of a Prune Marketing Board, to organise marketing and stabilise prices.

Returns for apricots, peaches and plums were generally satisfactory. Small and inferior quality fruit sold poorly because of the good supplies of quality fruit.

No difficulty was experienced in disposing of the heavy canning peach crop for processing.

TROPICAL FRUITS INDUSTRY TRENDS

Banana Statistics.—The statistics for N.S.W. to 30th March, 1964 are:—

Total acreage	26,319 acres, producing 5,000,000 bushels of fruit
Area planted 1963-64 ...	1,164 acres
Area destroyed 1963-64 ..	2,244 acres
Net decrease	1,080 acres
Number of growers with over 1 acre	3,566

Banana Packing and Marketing.—Growers are now more conscious of the advantage of greater care of their fruit after harvesting. Use of water to clean and cool bananas is increasing.

Improvements in carton manufacture are taking place. Kiln dried pine 13 in. bushel cases have been tried and have given promising results when the fruit has been packed in clusters and handled correctly. It is anticipated that further use will be made of this container. A 14 in. telescopic carton for packing hands of bananas is being used by some growers and by a banana packing shed at Mullumbimby. This is a good container for hands.

A banana packing house was established at Mullumbimby by a small company of growers. This packing house handled large quantities of fruit while prices were low and supplies were heavy in the summer months. As supplies of bananas dropped and prices rose growers had more time and did their own packing. These conditions make it difficult for packing houses to succeed. Even so, a further packing house is being established at Coff's Harbour.

Fumigation of Pineapple Lands.—This is giving good results. The appearance of the crops has greatly improved.

Macadamia Industry.—The macadamia nut factory at Murwillumbah has moved to Brisbane. Larger quantities of nuts are being produced in Queensland than in New South Wales.

CITRUS INDUSTRY TRENDS

Production.—A fall in coastal districts' production has been offset this year by increases in the M.I.A., with 1,506,428 bushels of all citrus, and in the Lower Murray areas, with 807,000 bushels. Production at Narromine, though still small, is steadily climbing; 100,000 bushels production has been estimated for the coming Narromine season.

Juice Production.—The industry importance of juicing has grown during the year, with all districts except Narromine participating.

Road tanker movement of orange juice in 800 to 1,000 gallon lots from a Gosford processor to a milk distributing company at Parramatta for sale to shops and clubs was an interesting development. Of the M.I.A. Valencia crop, 14 per cent was absorbed by processors.

Plantings.—Citrus plantings have decreased in coastal districts; an outcome of rising land values, subdivision, age decline of trees, and replacement with higher-return crops.

Inland, new and replacement plantings at Narromine have slightly increased the total area there but per tree production is low because of the high proportions of trees under 7 years old; oranges 40 per cent, grapefruit 50 per cent and mandarins 50 per cent.

In the M.I.A. 24 per cent of the Valencias and 35 per cent of Navels are in the "under 7" age group. The position in Lower Murray areas is similar, with large numbers of trees in the non-producing stage on the more recently developed irrigation settlement of Mourquong, Buronga and Paringi.

In all of these inland places production is increasing and will continue to do so.

Post-harvest Processing.—The dip-rinse, brush, wax and dry process employing the mouldicide Sodium ortho phenylphenate (S.O.P.P.) in the dip tank has become generally accepted practice by producers. Almost all co-operative and proprietary packing houses are now using the process, while many growers have installed their own plants.

Colour-Add.—Pale oranges are unattractive and coastal grown oranges are often at a disadvantage because of this. A coastal packing house this year installed a "Colour-add" plant to enhance fruit colour by means of a dye known as Citrus Red No. 2. Oranges so treated may be marketed in Queensland under certain conditions but health regulations in other States so far do not permit fruit so treated to be offered for sale.

The New South Wales Citrus Growers' Council is seeking approval for the process in New South Wales.

Brand Stamping.—The practice of stamping each individual fruit with a brand name is catching on rapidly. One outcome has been better selection of fruit for quality and this has proved most rewarding.

Prices.—Price levels were more satisfactory than for the two immediately preceding years; due to lighter production and better quality.

Exports.—Interest in export of oranges and lemons remained high despite the lighter crop. It was helped by permission to export "picked" fruit on an experimental basis, subject to being put through the S.O.P.P. soak-rinse and wax treatment within a specified time after being harvested. The alternative of "clipping" each fruit is regarded by most growers as too slow and expensive.

The increasing interest in citrus export is seen in the figures for 1960 (33,906 bushels) compared with those for 1963 (122,359 bushels).

WINE AND WINE GRAPES INDUSTRY TRENDS

Production.—New South Wales production for the 1964 vintage is estimated at a record 36,500 tons, compared to the previous record of 34,028 tons in 1963.

M.I.A. production reached the all time high of 33,024 tons, compared with 30,784 tons in 1962-63. For the third successive season this district produced more than 30,000 tons, compared with the 20,134 tons average for the previous five years. Introductions of wine grapes from the Murray districts into the M.I.A. continued to fall however, from 1,861 in 1963 to 982 tons in 1964.

The Hunter Valley also had a good season; about 1,500 tons produced compared with 1,213 tons in 1963, and of generally high quality.

Total wine production in New South Wales for the 1964 vintage is estimated at 6,150,000 gallons, compared with 5,878,178 gallons in 1963.

Rapid M.I.A. Expansion.—Favourable seasons and good prices have led to rapid expansion in wine grape plantings in the M.I.A. At December, 1963, the total area there had reached 5,126 acres. In the last two years 817 acres have been planted. With yields averaging around 7 tons per acre, M.I.A. production could reach 40,000 tons by 1967, without any further plantings.

Considerable freight advantages are possessed by the M.I.A., over irrigation districts in South Australia, because of relative proximity to the Sydney and Melbourne outlets. So, winemakers are displaying much interest in the district. Capacity of local wineries has been expanded appreciably in recent years. In 1963 the M.I.A. produced 20 per cent of Australia's wine compared with 14 per cent in 1960.

Wine Grape Planting Trends.—As the area of wine grapes n N.S.W. is expanding rapidly, detailed analyses of planting rends have been made on an annual basis. The results have een published in the industry journals and used also in ther extension activities. Some of the trends that would ave led to overproduction of some varieties and a shortage n others have been arrested.

As a further safeguard, the Division of Horticulture and he M.I.A. Irrigation Research and Extension Committee ave succeeded in forming a wine grapes planting advisory ommittee. This, comprised of winemakers, growers and Department of Agriculture representatives, is to review plantng trends and make recommendations regarding future expansion in the M.I.A.

Moves to Establish Wine Production in New Areas.—Moves have been made by local interests to establish wine grape production in the Young and Molong districts, to increase closer settlement and employment. Considerable assistance has been given to the local organisation by way of echnical and economic advice. Each area is climatically uitable but immediate development is now unlikely, owing o the difficulty in securing an assured outlet for the crop.

Diversion of Sultanas.—Wine grape growers have been concerned by the large quantities of sultanas being diverted o wineries. The trend, if it continued, could result in surpluses of true wine grapes.

TABLE GRAPES INDUSTRY TRENDS

Production.—Table grape production in N.S.W. for 1963-64 will amount to a record 8,000 tons, compared with 6,537 tons in 1962-63. A good season and increased sultanas on the fresh fruit market were responsible for the big crop. In the M.I.A. the quantity of grapes marketed for table use reached 344,517 half bushel cases, as against 200,306 in 1962-63.

Generally fruit quality was good and prices were satisfactory, although numerous consignments were rejected at the City Markets because of immaturity.

Steady Increase in Plantings.—The non-bearing area of table grapes in N.S.W. rose from 8.5 per cent in 1962 to 15.4 per cent of the total in 1963, sufficient for a steady increase in the total acreage. Waltham Cross has replaced Purple Cornichon as the most popular variety for new plantings in the M.I.A. Difficulty is being experienced in obtaining sufficient colour in Cornichons and large quantities are now sold to wineries. There is room for expansion of Black Muscat, the State's most important table grape, in the early and late districts.

Loose Packs.—Loose packing in oversize cases is gaining in popularity. Where reasonable handling care is taken there is much less damage to bunches loosely packed than in the conventional tight packs. The table grape market has become highly competitive and for remunerative prices growers have had to adopt every known means of improving quality.

DRYING GRAPES INDUSTRY TRENDS

Production.—A record crop of dried vine fruits is expected from the 1963-64 season. Production in N.S.W. should reach 13,500 tons, compared with 9,023 tons in 1962-63. Bud fruitfulness (46 per cent) was not high but there were useful rains early in winter and drying conditions have been perfect.

Prices.—Owing to world shortage of dried vine fruits, the 1963 crop sold readily on overseas markets. Prices are expected to average over £130 per ton, 30 per cent higher than in the previous year. Good overseas demand for the current year's crop is expected.

Stabilization Plan.—Dried vine fruit growers recently accepted a stabilization plan offered by the Commonwealth Government. Also, agreement was reached with major exporting countries on minimum prices for dried vine fruits for the 1963 crop and a new agreement is expected for the 1964 crop. These developments have greatly improved the outlook for the industry.

Plantings.—The non-bearing area of dried vine fruit in N.S.W. has increased from 4.0 per cent in 1962 to 6.4 per cent of the total in 1964. This rate of planting is more than sufficient to maintain the present acreage. Although the market outlook has improved, any major expansion of plantings could not be justified.

Regulatory Services

DISTRICT AND SUBURBAN INSPECTIONS

Pest and Disease Control.—Spray calendars for regional areas have been revised to include new materials and advanced recommendations.

Special warning services were maintained for growers in respect of pest and disease activities and reports from all districts indicate that reasonable control was achieved.

Bunchy Top disease in bananas has been well controlled. Only 910 infested plants were detected. This equals 3.43 plants per 100 acres under bananas. Banana Beetle Borer is now well controlled in the northern areas but sporadic outbreaks in southern areas have been a cause of some concern. The banana nematode *Radopholus similis* appears to have been checked by the use of heat-treated planting material. A heat treatment plant has been operating in the Tweed district to good purpose.

Citrus Gall Wasp has given trouble in the Gosford area but commercial orchards have so far avoided serious infestation. A vigorous campaign is in operation, to ensure that nurseries do not distribute infested planting material and to contain the pest within its present bounds.

The value of a two spray control programme for citrus Red Scale has been successfully demonstrated in the M.I.A. by active extension work.

Prohibition of Grape Introductions from South Australia.—Following an examination of South Australian vineyards infected with the disease known as "Dying Arm", entry of grapevines from that State into N.S.W. has been prohibited. Dying Arm, cause unknown, has become the most serious problem of grapes in South Australia, but has not been observed in N.S.W. Previously, substantial numbers of grape rootlings were brought into N.S.W., mainly to the Hunter Valley district.

Fruit Fly Campaign.—This was another successful year in the "whole town treatment" work. Four more Councils undertook the method, guided by the Department. This brings the total to 16 Councils so co-operating in fruit fly control, with prospects of four more in 1964. Marked success has been achieved by these methods in all towns so treated.

A spectacularly clean season was recorded for Broken Hill; where epidemic infestations in 1960 have been progressively reduced to the present position. Fruit fly has not regained epidemic proportions in any of the towns under treatment. No infestation has been recorded at Narrandera and Leeton since the epidemics in 1960.

Councils have appreciated being able to purchase the chemicals at special reduced rates, as sponsored by the Department of Agriculture.

Widespread adoption of the new male-attractant lure has occurred through special presentation of this lure for home gardeners.

The Department has continued to meet half the cost of the Euston Road Block established to help protect Victoria, South Australia and the Murray River areas of N.S.W. against introduction of the fly by travellers.

CITY MARKETS AND INTERSTATE SUPPLY INSPECTIONS

Apples.—Heavy supplies of the 1963 crop continued until later than usual. Many growers held fruit hoping for higher prices which did not eventuate. Much of this was in due course down graded because of storage disorders, ice scald and break-down. The overall crop was lighter than last year's and much of the fruit was small to medium.

Pears.—These came mainly from Victoria, Orange, Bathurst and Batlow. The N.S.W. fruit was good and in keen demand. The pears from Victoria were of variable quality, in most cases inferior to the N.S.W. fruit, and in poor demand.

Oranges.—Supplies of Valencias from Queensland and the N.S.W. central coast were heavy early, followed by good quality oranges from the M.I.A. Main causes of down grading of Valencias were black spot, sooty mould, melanose, silver scurf and dead red scale. Valencias from South Australia were of very high quality and met a keen demand; 800 cases were withheld from sale because of dryness.

Navels commenced to arrive from Queensland in late March and met a keen demand. A strict check on all consignments resulted in only 60 cases being withheld from sale because of immaturity. Navels from N.S.W. districts started to be marketed soon afterwards. Growers had obviously taken care to have their fruit tested before forwarding: 170 tests at the market for maturity resulted in only 100 cases of oranges being withheld from sale.

Mandarins.—Local fruit was small, poorly presented and heavily affected by melanose and sooty mould. So, large quantities were marketed as plain grade. Ellendales from Queensland were medium to large, of good colour and free from blemish, but tended to puffiness towards the end of the crop.

Lemons.—Supplies from the coastal districts have been very spasmodic and of poor quality with distinct fall-off during January. Thus some very poor quality fruit achieved high prices. Supplies were augmented during this lean period by about 4,000 cases from Western Australia. Meyer lemons from Queensland were basically excellent but tended to mould.

Grapefruit.—Supplies were light from all areas. Most fruit from local areas was marketed as plain grade. Quality and presentation of the friut from the new packing shed at Narromine were excellent.

Peaches.—Local peaches were of fair quality but rather small. Brown rot incidence was negligible, due mainly to the dry season.

Nectarines.—These were in light supply, with a tendency to rapid breakdown.

Plums.—Wilson and Santa Rosa varieties from the Hills districts met the early season demand, followed by Narrabeen and Angelina, and President varieties from the M.I.A., ensuring a long season of good quality fruit. Some breakdown occurred late in the season.

Apricots.—Early supplies from local districts were small, hard, and poor. Later supplies, from the M.I.A. and Victoria, were of very good size and quality.

Cherries.—The cherry crop was excellent. Towards the end there was bad rain damage.

Grapes.—This was a very favourable season for grapes and from all districts the fruit was excellent. Once again growers from Queensland and Victoria, to capture the early market and high prices, marketed immature grapes; resulting in 15,400 cases being withheld from sale because of immaturity.

Bananas.—Supply was constant throughout the summer, with normal decline in the winter months. Quality and presentation have been good. Glut supplies depressed the market returns.

Pineapples.—The fruit has been sound and supply moderate throughout the season.

Strawberries.—Early supplies from Queensland arrived in July, and were good quality and well presented. Local supplies appeared in October and December. Air-freighted large well coloured strawberries from New Zealand ensured a regular supply from November to April.

Potatoes.—Because of the very dry summer, potatoes from Victoria and New South Wales had a high percentage of smalls, also infestation by potato moth. Heavy rains early in autumn brought relief and moth infestation disappeared. The new season potatoes from Queensland and Victoria were of good size and quality. The main varieties on the market were Sebago, Sequioa, Brownell, Bismark, Kenebec, Delaware, Exton, Murru and Pontiac.

EXPORT INSPECTIONS

Fresh fruits, seed, rice, wheat and flour submitted for export were examined on behalf of the Commonwealth Department of Primary Industry under the provisions of the Commerce (Trade Descriptions) Act.

Apples.—A total of 179,784 cases and cartons of apples were shipped through the Port of Sydney; about 36,000 less than in the previous year. The main bulk of the New South Wales export fruit was from the M.I.A., Forbes, Kentucky, Batlow, Bathurst, Camden and Bilpin areas.

Quality of the apples shipped was good; 7,477 cases and cartons were rejected for bruising. sun scald, overmaturity, black spot, bitter pit, russet and San Jose scale.

Pears.—Some 31,855 cases and 879 trial shipment cartons of pears were shipped from Sydney: mainly Packhams Triumph, from Kentucky, Batlow, the M.I.A., and Bathurst. All were pre-cooled prior to shipment. Rejections totalled 1,927 cases; for overmaturity, breakdown and incorrect pre-cooling temperatures.

Citrus Fruits.—A total of 12,951 cases of Navels was inspected for export and, of these, 1,965 cases were rejected for moulding, Albedo breakdown and silver scurf. Some 74,077 cases of Valencias were shipped through Sydney, including 46,313 cases of experimental "picked" oranges. Valencia rejects were fairly light; only 1,599 cases rejected, for Phenate burn, black spot and sooty mould.

Lemon shipments from Sydney totalled 12,636 cases; an increase of about 5,000 on the previous year. Rejects totalled 578 cases; for Phenate burn, and sooty mould. The fruit generally was of good quality. Most was supplied from the M.I.A. and coastal sources.

Only 1,804 cases of Grapefruit were shipped through Sydney, in the main to Fiji, Penang, Singapore and New Guinea.

Grapes.—7,126 cases were shipped, mostly packed in cork. The fruit generally was of excellent condition. It was exported to Fiji, Hong Kong, Borneo, New Guinea and Pacific Islands.

Tomatoes.—9,736 cases were shipped from Sydney, mainly locally grown. It was consigned to New Guinea, Pacific Islands, Singapore and Borneo.

Flour.—A total of 184,494 tons of flour was exported. It included 27,091 tons exported to Russia, the first shipment of flour to that country from this State. The total of rejections was low, only 252 tons, comprising 200 tons because of wetness incurred during transit by rail and 52 tons infested by flour beetle.

Rice.—Exports totalled 42,829 tons, in the main consigned to New Guinea, New Zealand, Pacific Islands, Fiji, U.S.A., and Borneo.

Seed.—Large quantities of seed were exported, mainly to the U.S.A., New Zealand, Japan, Hong Kong and Pacific Islands. The total included 9,805 bags of pasture seed, 1,797 bags of various tree seeds, 25,639 bags of various cereal seeds, 72 consignments of flower seeds and 2,605 consignments of vegetable seeds in packets.

Wheat.—The new grain regulations have greatly increased the work. Some 215 vessels were surveyed and 41 of these were rejected because of infestation and had to be fumigated or treated before permission was granted for them to load wheat.

A total of 1,961,842 tons of wheat was exported, an increase of 1,135,925 tons over the corresponding period of last year, and 308,617 tons were rejected because of infestation.

Destinations of this wheat were: China, 921,344 tons; Russia, 421,001 tons; United Kingdom, 172,992 tons; Germany, 83,991 tons; Africa, 70,042 tons; New Zealand, 81,370 tons; Bierra, 24,879 tons; Singapore, 38,777 tons; Manilla, 11,452 tons; Norway, 2,968 tons; Spain, 2,050 tons; India, 22,401 tons; and Japan, 8,556 tons.

IMPORT INSPECTIONS

Importations of plants and plant products from overseas were examined for the Commonwealth Department of Health in accordance with the provisions of the Quarantine Act.

Seeds.—Imports of pasture seed (grasses and clover) were mainly from New Zealand and U.S.A., with lesser quantities from Holland and the United Kingdom. The import total was 42,337 sacks. Of these, 1,820 sacks were quarantined and had to be fumigated for insect infestation or recleaned to remove prohibited seeds. This import total was 12,304 sacks more than in the previous year.

Totals of 58,479 lb. of flower seed and 200,845 lb. vegetable seed were imported.

Nursery Stock.—Because Plant Quarantine policy requires a reduction in volume of imported rooted materials, the quantity of nursery stock being introduced into this State has diminished. The following quantities of plants were imported and held in quarantine under the Nursery Stock Regulations: orchids 4,225, ornamentals 1,689, rhizomes, etc. 306, rose budding eyes 2,531, and sugar cane cuttings 42.

Insects were in some of the consignments and the materials were either dipped or fumigated. In other consignments various diseases were found and the material was destroyed or returned to the country of origin.

Parcel Post.—All parcels containing plants or any kind plant material arriving from overseas were examined at rcels post: 7,302 parcels were examined and 868 were etained for further examination and treatment. Contents the parcels were mainly plants, bulbs, seeds, peanuts, pcorn and raw cotton.

Cases and Packing.—At overseas wharves there was daily spection of cases and packages containing general mer- andise, for detection of Sirex Wasp and other wood boring sects. Infestation was found in 1,934 wooden cases; 1,275 f various bundles had bamboo slats; 249 casks had bamboo inding; 294 of various packages had rice straw binding and 4 cases had straw packing. All of these were treated under pervision either by fumigation or heat, or destroyed.

Dunnage.—Considerable dunnage was placed on the wharves om overseas ships and 300,200 super feet of this dunnage as fumigated under supervision; about 77,200 super feet ore than was treated last year.

Passenger Ships.—Some 243 passenger ships were met, for xamination of goods and articles brought to attention by ustoms. Considerable prohibited and infested goods brought attention included fruits, plants, seeds, and wooden cases.

Aircraft Inspection.—The flights of overseas aircraft arriv- g at Mascot totalled 3,785 and these discharged 236,712 assengers. The total of flights attended to by Plant Quaran- ne officers was 2,120. In future all flights will be covered.

Timber.—The major concern this year has been the high ercentage of borer infestation in oregon; identified as *Pityoph- horus* sp. and *Gnatotricpus* sp. This is the first occasion hat infestation has been detected in this type of timber. It esulted in 109,000 super feet being quarantined and heat reated. Oregon imports continued to increase, and the total f 33,000,000 super feet provided an increase of 34 per cent ver last year's total.

Borneo and Malaysia are still the main source of infested imber. The main wood-boring insects detected were Bostny- hidae and Lyctidae in Maranti timber and *Xyleborus* sp. nd Platypodidae in Serayah logs.

Some 470,000 super feet of sawn timber and 2,900 logs, epresenting 3,500,000 super feet were quarantined.

All timber quarantined was found to contain live borers. Specimens were submitted to Forestry for identification. The nfected logs were sprayed weekly until cut, and the milling as supervised to ensure destruction of of infested off-cuts nd sapwood and treatment of timber retained for normal se. All infested sawn timber was heat treated under supervision before release.

Timber imports totalled 216,272,000 super feet; 11 per ent more than last year's total.

General.—Eight hundred and eighty-two ships entered the Port of Sydney carrying goods subject to quarantine inspection, which resulted in the following actions:— *Copra*: all copra was infested with moth and moth larvae, and was processed under supervision; *garlic*: garlic from Mexico, Egypt, and New Zealand required treatment for infection by *Helminthosporium allii* (bulb canker); *cashew nut cases*: all consignments of cashew nuts included cases infested with borers, some severely, and necessitated treatment of all cases; *peanuts*: some consignments of kernels were insect infested, but in every instance of oil culls treatment was prescribed because of infestations; *whole spices*: a high percentage, especially of spice seeds, was detained because of foreign seeds and soil, and where cleaning for foreign seeds was not practical, grinding was supervised; *motor vehicles*: besides inspections of used vehicles, about 1,000 new vehicles were inspected and some required steam cleaning.

DIVISION OF ANIMAL INDUSTRY

General

VETERINARY DIAGNOSTIC SERVICES, GLENFIELD

The Veterinary Research Station, Glenfield, continued to examine for diagnostic purposes specimens submitted by Departmental field officers, practising veterinarians and livestock owners. Specimens received totalled 44,997, compared with 45,760 for the previous year, when the swine fever outbreak considerably increased the material examined. In 1963-64 the pig specimens totalled 3,304, as against 9,201 in 1962-63. For other species the figures for 1963-64 increased considerably.

VETERINARY EXTENSION SERVICES

Investigations into herd and flock problems on individual properties by field veterinary officers and veterinary inspectors afforded opportunities for a lot of extension work. The veterinary staff also made considerable use of group contacts and of mass media—press, radio and television.

Demonstrations were given at some twenty field days. Lectures, demonstrations and film discussions were provided at fifty meetings. Radio broadcasts totalled sixty-nine, and numerous articles and pars were made available to the press.

One short course for farmers, on diseases of cattle, involved six lectures. In addition, lectures were given at a further five extension schools conducted either by the Department or other bodies. Three one-day schools were held for anthrax inoculators.

Those veterinary extension services were provided notwithstanding numerical shortage of veterinary officer and veterinary inspector staff. The field veterinary services were fulfilled by ten district veterinary officers and twelve veterinary officers of the Department, and thirty-three veterinary insectors employed by Pastures Protection Districts but under Department of Agriculture jurisdiction. Their primary function is regulatory work, but educational activities comprise an important ingredient.

VETERINARY RESEARCH STAFF, GLENFIELD

At the Veterinary Research Station, Glenfield, the research staff comprised twelve veterinary research officers, three livestock research officers, one research officer and two technicians. Vacancies existed for a virologist and a poultry research officer. One veterinary research officer resigned, while two were appointed.

Two of the veterinary research officers completed Ph.D. courses in Veterinary Pathology and Parasitology at the Universy of Sydney. Another commenced post-graduate training in Virology at the C.S.I.R.O. Virus Research Centre, Parkeville. A livestock research officer commenced a Ph.D. course at the University of New South Wales.

ARTIFICIAL INSEMINATION

Training of Inseminators.—In collaboration with the N.S.W. Milk Board, seven schools for inseminators were held, by the Glenfield Veterinary Research Station. Certificates of Competency were issued to twenty-two candidates.

Test Mating of Bulls.—All bulls prior to entering artificial stock breeding centres underwent test mating at Glenfield Veterinary Research Station for venereal diseases, and were tested also for tuberculosis, brucellosis, leptospirosis and pleuro-pneumonia contagiosa. Twenty-one bulls were tested. One of them proved positive for vibriosis. None of the other bulls was found affected by any disease.

RABBIT MYXOMA VIRUS

The total of 55,225 doses of Myxoma virus issued to pastoralists in N.S.W. by the Glenfield Veterinary Research Station for control of wild rabbits was the highest for the past five years, though well below the 1953-54 peak of 296,900 doses.

DISEASE INCIDENCE NOTES

Brucellosis (Cattle)

Numerous cases of this were investigated, particularly in dairy cattle. Control is voluntary, by the use of strain 19 vaccine. For diagnostic purposes in herds, and also in cattle for export, exhibition and sale, agglutination testing was done.

Ten herds were accredited under the voluntary Brucellosis-free Herd Scheme. In these herds 643 cattle were tested with negative results.

Advice was given to owners on the control of the disease in herds where evidence indicated *Brucella abortus* transmitted through milk had been the cause of undulant fever in humans.

Brucellosis (Sheep)

Complement fixation testing was done for diagnosis and eradication. A system of charges was introduced for the testing of sheep for purposes other than diagnosis on a flock basis. This reduced interest in eradication, but increased the tendency of flock owners to control infection by vaccination. Vaccination has taken the form of combined inoculation with strain 19 *Brucella abortus* vaccine and the adjuvant *Brucella ovis* vaccine.

One case of severe reactions following the inoculation of eighty-five Merino rams was investigated. Eighty per cent of the rams developed a severe painful orchitis. However, most had recovered in about three weeks with no permanent impairment of fertility.

The disease was responsible for low lambing percentages in many flocks, particularly British breeds. In a group of 130 ewes mated to four badly affected Border Leicester rams, not a lamb was born.

A voluntary Brucellosis-free Flock Scheme is being organised, in the hope that it will ensure a supply of unaffected stud rams for use in commercial flocks.

Encephalitis

In an outbreak of an encephalitic condition in calves on the central coast about 50 deaths occurred on a similar number of properties over several months. The holdings were widely separated. Usually only one animal became affected on any one property. Affected calves were mostly in the 4 to 8 months age group, but some cases appeared in older animals.

Symptoms consisted of incoordination, ataxia, hyperaesthesia, opisthotonis, and loss of eye reflexes. Lesions consisted of severe perivascular cuffing and diffuse and focal macro- and microgliosis mainly confined to the brain stem and grey matter of the cord. The lesions did not appear typical of either sporadic bovine encephalomyelitis, or encephalitis caused by the virus of infectious bovine rhinotracheitis.

Enterotoxaemia (Cattle)

There were widespread reports of this condition but confirmation was possible in only a few cases. Mortality in individual herds was light.

Enterotoxin was demonstrated in 18 cases. In 8 of these it was not possible to type the toxin, mainly because it was too weak. Of the remaining 10 cases, 8 samples neutralised *Clostridium perfringens* type D antisera, one neutralised type E antiserum, while in the other case the toxin was not neutralised by antisera of any of the recognised *Cl. perfringens* types.

Enterotoxaemia (Sheep)

There were epidemics during the spring months in many areas where it is normally sporadic and preventive inoculation is not undertaken. Losses of 200 to 500 lambs occurred on many sheep stations.

A chronic form of the disease occurred on some properties. Symptoms were profuse scouring and loss of condition with eventual death up to two weeks after appearance of symptoms. The syndrome resembled that of coccidiosis. The gross pathology was similar to that of acute enterotoxaemia with glycosuria in evidence. Vaccination checked losses.

Foot Abscess (Sheep)

This condition, with *Fusiformis necrophorus* associated and suspected as the cause, was highly prevalent during the wet period of spring in many areas. It constituted a greater problem than footrot. Many outbreaks led to mortality from pregnancy toxaemia, due to inability of affected pregnant ewes to graze.

Some owners reported reduced incidence after using cattle footrot vaccine. Controlled tests of the efficiency of this vaccine against foot abscess will be undertaken.

Goitre (Sheep)

Several outbreaks in new born lambs occurred on the northern tablelands. Goitre has not been previously recorded there. The incidence of affected lambs in the flocks involved was not high. On all involved properties the ewes which gave birth to affected lambs had been grazing on New Zealand white clover.

Leucosis in Turkeys

This condition was diagnosed in turkeys for the first time in New South Wales. Histopahological examination confirmed it. Two separate outbreaks occurred. The number of birds affected in each case was small.

Listeriosis

Several outbreaks of the encephilitic form occurred. With one exception mortality was light. The exception was a mob of 2,600 in-lamb ewes travelling from one holding to another. Approximately 200 ewes died. A further thousand aborted their lambs.

On six properties, listeriosis was found to be the cause of abortion and neonatal lamb losses. In some instances vibriosis and toxoplasmosis were associated.

Necrotic Enteritis (Poultry)

A condition characterised by necrotic enteritis, and resembling one previously described as due to a strain of *Clostridium perfringens* affected young chickens in several flocks. Birds have become affected at 4-5 weeks of age. Symptoms resembled coccidiosis and there was up to 25 per cent mortality. Principal necropsy findings were intense necrotic enteritis with, in some cases, proventriculitis and erosion of the gizzard membrane. Smears repeatedly revealed *Vibrio* spp. As yet however it has not been possible to isolate these organisms.

Furazolidone did not check losses but one outbreak seemed to respond to inclusion of sodium bicarbonate in the drinking water.

Parasites Internal (Cattle)

A number of adult cattle mortalities, in various areas, were due to heavy infestations with *Ostertagia spp.* The parasite mostly involved was *Ostertagia ostertagi,* but in one case about 5 per cent of the adult parasites were *Ostertagia lyrata*—only the second occasion this parasite has been recognised in Australia. Bulls tended to be affected relatively more frequently than cows.

Two to three thiabendazole treatments, fortnightly, appeared necessary to restore affected animals to normal health. The reason for failure of single treatments was not determined, but release of arrested prepotent parasites following removal of adults has been considered as a possibility.

Poisonings

2-phenyl-benzimidazole.—This drug was marketed during the year after preliminary trials indicated it to be highly efficient for the removal of worms in sheep. However, when used in commercial flocks toxicity occurred over a wide area. Most mortalities comprised 5 per cent or less of treated sheep. However, several cases of up to 20 per cent mortality occurred. One owner lost 110 of 150 treated ewes.

The drug was found to become toxic under conditions producing an acid urine. This was mostly associated with sheep grazing on dry pastures. In flocks wherein losses occurrred a variable proportion of the remaining sheep showed general loss of condition. This also occurred in some flocks where there were no deaths.

The most consistent necropsy findings was in the kidneys. These organs were enlarged, in some cases up to three times normal size. On sectioning, white striations were seen in the medulla extending towards the cortex. An amorphous crystalline material was usually present in the bladder, the renal pelvis, and in some cases within the kidney tissue. At times there were obvious renal infarcts and areas of necrosis.

Some wethers showed necrosis of the urethral process and blockage of the urethra, leading to retention of the urine and in some cases rupture of the bladder. Characteristic histopathology of the kidneys has been masses of crystalline amorphus material in the cortical and medullary tubules. There was variable thrombosis and infarction, and interstitial nephritis.

The manufacturers withdrew the drug from the market.

Lathyrus articulatus.—A mortality of 15 cows out of 60 occurred after grazing on this species of vetch, grown for fodder purposes. Symptoms did not appear until the cattle had grazed the crop for some two months, but death rapidly followed the onset of symptoms. There were no recoveries.

Symptoms were weakness, prostration, and weak rapid heart beat, with stabismus, and congestion of the conjunctival vessels. The principal necropsy finding was a dark colouration of the blood.

Sodium Fluorocetate.—This preparation, "1080", is used tensively as a poison for wild rabbits. It caused stock losses a number of instances. Owners are recommended to re- ove stock from paddocks in which poisoned bait is laid. ortalities were recorded when stock were returned to treated ddocks up to six weeks after the poison had been deposited. one mortality 60 of 1,200 Merino wethers died.

Swainsona galegifolia (*Darling Pea*).—This plant, widely stributed throughout the north-west and west, continued to use sickness and death in sheep and cattle. This year a more tailed study of the histopathology of cerebral tissue from fected sheep was made at Glenfield Veterinary Research ation. Two types of lesions which appear to be characteristic re revealed:—

Type 1: Varying numbers and sizes of eosinophilic more or less spherical bodies were seen in the brain stem, particularly the internal capsule, cerebella peduncles and medulla, and in the cord. These bodies are considered to be swollen and degenerating axons. While not specific to *Swainsona* poisoning, they are not known to occur in such profusion or with the same topographical preferences in any other disease of the central nervous system in sheep or cattle.

Type 2: There were varying degrees of swelling and fine vacuolation of neurones. The most commonly and severely affected were the large neurones of the hind brain stem and cord and the Purkinje cells of the cerebellum.

Urea.—Heat-fused salt blocks containing 35 per cent urea re used by many stockowners to provide nitrogen to stock razing on dry pastures low in this element. Toughness of the lock normally restricts urea intake to a safe level.

Several mortalities occurred from these salt blocks; where ere was failure to meet the animals' mineral requirements rior to making the blocks available, or where the blocks had ecome softened through exposure to rain.

Pseudolipidosis (*Cattle*)

Five cases occurred in Angus calves on five separate pro- erties. It is of unknown aetiology and has not occurred in ther breeds. Symptoms are retarded growth, ataxea, muscular remors and in older animals a tendency to charge. Lesions omprise widespread vacuolation of brain and lymph gland ells.

Rumenitis (*Sheep*)

Loss of 50 of 1,200 sheep occurred in a flock which was eing fed oats in addition to grazing on improved irrigated astures. Post-mortem revealed large areas of inflammatory ecrosis extending right through the mucosa of the rumen, with nderlying severe acute infected inflammatory oedema and aemorrhage. A similar condition has been met previously n sheep fed on manufactured concentrate nuts.

The condition might be a mycotic infection, proliferating in he ruminal liquor of lowered pH, followed by secondary nvasion of the sub-mucosa by toxin-producing clostridia.

Sporadic Bovine Encephalomyelitis

It has been established that the condition formerly known as ransmissible serositis is sporadic bovine encephalomyelitis. It was enzootic for many years in a localised part of the north west. This year there was evidence of much wider spread. linical cases were recognised in several new areas.

Toxic Heart Degeneration (*Turkeys*)

This condition, known also as "round heart disease", was found affecting turkey poults one to two weeks of age. In a group of 300 poults losses totalled 240. This is believed to e the first case of it in New South Wales.

Toxoplasmosis (*Sheep*)

This had been previously suspected in sheep abortion and neonatal losses but the disease was not confirmed until this year. Toxoplasmosis was diagnosed in three flocks by detection of the casual organisms. In four other flocks, the histopathology was indicative. On one property where diagnosis was positive, near to 70 per cent of lambs born had been lost. In some cases the disease was operating in conjunction with other causes of neonatal lamb deaths.

Uraemia (*Poultry*)

Incidence of this increased considerably in 1964. It is one of the most common diseases in poultry in this State. As birds of the 5 to 11 weeks age group are most frequently infected, the disease is of particular economic importance in the broiler industry.

Recent Australian research strongly suggests that most if not all outbreaks of uraemia are caused by the virus of infectious bronchitis. This can spread rapidly under modern management conditions. The virus usually causes mild respiratory symptoms in chicks within days of introduction of infection. Many birds later develop the nephritic form of the disease. Losses may be as high as 30 per cent.

At least two commercial firms have developed infectious bronchitis vaccines. These are being field-tested in co-operation with the Department.

Vertebral Displacement (*Sheep*)

A few sheep on one western property are affected each year with posterior ataxia. It becomes evident on driving. Sheep are noticed affected from five months of age onwards.

Two affected sheep consigned to Glenfield Veterinary Research Station showed a prominent raised wither and depressed neckline. On post-mortem the first thoracic vertebrae were found to be displaced into the spinal canal, with resulting compression of the cord. In the cord at the point of constriction there was severe ballooning of myelin sheaths and axonal degeneration.

Close observation of new born lambs in the flock revealed one lamb unable to raise its head from birth. The dorsal cervical muscles of this animal were affected by severe myonecrosis of several days standing. A good correlation has been established in Scotland between lambs so affected at birth and the development of vertebral displacement.

Virus Abortion (*Sheep*)

Elementary bodies resembling those found in virus abortion, have been seen in cotyledionary smears from two properties where neo-natal lamb losses were occurring. This disease has not been previously recorded in New South Wales.

From specimens from the first property, a psittacosis-lymphogranuloma (P.L.G.) type virus was isolated in the yolk sac of developing eggs. A group of pregnant ewes was challenged with this agent but all lambed normally. The ewes, 4-4½ months pregnant, probably were too advanced in pregnancy for successful challenge. Two further groups of ewes have been challenged, at 2-3 months gestation. The results are awaited. Complement fixation tests for Q fever have been negative, and not clear cut with the P.L.G. group.

White Muscle Disease (*Sheep*)

This condition was common in spring on the New England, among lambs on clover-dominant pastures. Prophylactic administration of selenium is now widely practised in this area.

Lesions of muscle necrosis somewhat resembling white muscle disease were found in the far west under conditions not typical of those which predispose to this disease. The property concerned was of low carrying capacity and the feed at the time comprised coarse dry pasturage. Some 300 of 4,000 died; mainly ewe and wether lambs but some adults. The deaths took place over two days and followed yarding for crutching.

A similar condition was found from time to time in sheep slaughtered at Wagga Abattoirs. In these cases muscle lesions were usually confined to the thoracic portions of the ventral serrate muscle. The myonecrosis appeared to have occurred at the one time. It was not progressive nor reparative, but was accompanied by an interstitial myositis. Only sheep which were walked several miles from the saleyard to the abattoirs were affected, not sheep conveyed by motor vehicle.

Research for the Livestock Industries

SHEEP INDUSTRY RESEARCH, GLENFIELD VETERINARY RESEARCH STATION

Veterinary

Vibrosis.—Investigations concerning the so called "venerealis" and "intestinalis" groups of *Vibrio fetus* organisms were continued. Large numbers of ovine sera from suspected vibrio flocks were submitted to agglutination tests. Results so far suggest that bovine strain 1980 antigen may be more suitable for vibriosis detection in sheep flocks than are antigens prepared from vibrio strains recovered from sheep.

Brucellosis.—Due to increasing emphasis on control by vaccination, and New Zealand reports of a vaccination method involving two injections of dead *Brucella ovis* suspension eight weeks apart, a trial using an Australian-prepared vaccine was commenced to confirm the New Zealand findings. This trial gave inconclusive results due to failure to challenge successfully the control animals with virulent *Brucella ovis.* But further work will be conducted along two lines.

Firstly, the Australian brand of vaccine having failed to produce a convincing serological response in most animals, its effect will be compared with the New Zealand vaccine's; secondly, the failure to infect control animals with *Brucella ovis* has suggested some work to determine an infective dose for the Australian strain of organism being used. In these lights there will be a trial to:—

(*a*) study the effect of vaccination on ram fertility, with both the New Zealand and Australian vaccines, with and without simultaneous use of Strain 19 vaccine;

(*b*) compare the serological response to each method of vaccination; and

(*c*) compare the efficiency of vaccination in the four groups of rams by subsequent challenge with a known infective dose of *Brucella ovis;* involving a preliminary trial, with 25 rams, to determine a satisfactory infective challenge dose.

Semen appraisal will be conducted weekly for 16 weeks from the date of initial vaccination on all animals. The semen will be collected by electro-ejaculation. Semen smears will be prepared at the same time to detect any cellular changes or the presence of *Brucellae.* Serum samples will also be collected weekly and tested in the complement fixation test for *Brucella ovis* and the agglutination test for *Brucella abortus.* The rams will all be challenged at 16 weeks and serum will be collected weekly. The semen will be cultured to detect evidence of infection. Manual palpation of the scrotal contents will be performed to detect evidence of clinical lesions.

The Complement Fixation Test has in general functioned satisfactorily as a diagnostic tool. But antigen preparation has at times presented problems. Satisfactory yields of antigen have been recovered from growing *Brucella ovis* in each of the following three ways:—

(*a*) large volume broth cultures, with 10 per cent CO$_2$ in air bubbled through continuously;

(*b*) culture on serum agar in roux flasks, incubated at 37°C. for five days in the presence of 10 per cent CO$_2$;

(*c*) on blood agar plates, incubated at 37°C. for five days in the presence of 10 per cent CO$_2$.

However, inoculum used has to be a freshly isolated strain of *Brucella ovis.* A strain sub-cultured more than three or four times on blood agar plates yields very little or no antigen by any of the methods. The organism's loss of its rough characteristics seems to be accompanied by loss of its complement fixing antigen. This aspect is being studied.

Toxaemic Jaundice.—As part of a survey of drinking water in relation to stock health, a preliminary series of 37 water samples from the south-western slopes was examined for copper and molybdenum levels. Values ranged widely but with little significance. Copper levels ranged from 13.5-270 ug/gallon (0.3-6 ug/100 mls). Molybdenum levels ranged from nil to 427 ug/gallon (9.5 ug/100 mls). The single sample giving a high value of molybdenum was so greatly different from all others as to suggest contamination.

Trials designed to provide basic information on the effects on plant copper, molybdenum, sulphate and protein, of lime, molybdenum (two levels) and gypsum (two levels) applications to plots of lucerne and subterranean clover regularly dressed with phosphate are continued. The ratio of copper: molybdenum in lucerne ranged from 42.5: 1 down to 0.7:1, and in subterranean clover from 134:1 down to 0.23:1, according to treatment applied. The persistence of these effects will be studied over several years. Atttempts to determine seasonal fluctuations will be made each year.

If the seasons are suitable, this should provide adequate information for animal studies. The ultimate aim is at more accurate field recommendations for control.

Footrot.—Following commercial interest in possible use of dichlorophen as an aqueous suspension for use in footbaths, the material was tested on infected sheep under pen conditions. At dilutions of 0.03 per cent and 0.015 per cent this drug was quite ineffective. Control animals remained infected. Animals treated similarly with five per cent formalin were completely cured after two treatments.

Of interest, although pen floors were covered with moist faecal material throughout the period of 53 days, no spread of infection occurred in any group. This emphasised the unreliability of transmissibility studies under artificial conditions.

Internal Parasites.—The organic phosphate S.940 was further examined. Its efficiency against immature stages of *H. contortus* and *T. colubriformis* was determined. This compound is probably the best of this type of anthelmintic now available.

Similar efficiency trials were conducted with "Phenzidole", a piperazine complex with phenothiazine, and "Coopazine 2", against mixed infections in sheep.

At Shannon Vale the thiabendazole trial continues. The treated group is much superior to the controls both for body and wool growth.

The relative importance of tapeworm infections in sheep is brought forward from time to time. Two field trials have been carried out with field officers' co-operation, to clarify the matter. Groups of infected lambs at Albury and Cooma were treated with various anthelmintics—yomesan (lintex), lead arsenate, R.D. 11798, and tin arsenate, and regularly examined for differences in rate of growth and worm burdens. One group was vaccinated for enterotoxaemia to see if toxin from this organism interfered with growth or health.

Little effect was achieved with tin arsenate but treatment with lead arsenate removed most and yomesan all of the worms present in the respective groups. Any improvement in growth rate was seen only in the yomesan group. Further trials failed because the tapeworm burdens were insufficient.

The "Medicated Licks Trial" at Shannon Vale has ended. The phenothiazine molasses lick group showed poor weight gains in comparison with the group receiving thiabendazole monthly. In the untreated group about 30 per cent died from trichostrongylosis. None died from the lick group. It was concluded that under certain conditions such a lick could be useful. Fleece weights from the lick group were only slightly higher than those from the controls.

New anthelmintics for fluke were tested at Glenfield and in the field. Hexachlorophene, carbon tetrachloride, bithionol and T.C.C. were used. Carbon tetrachloride is still the recommendation for sheep, but some of the others showed promise and the work will be continued.

Nicotine acid and santoquin were used to prevent deaths from carbon tetrachloride, with insignificant results. Hexachlorophene incorporated in a molasses lick has been proposed for fluke control. This will be investigated.

Toxicity trials were carried out, using lead arsenate, phenzidole (gainex), bithionol, T.C.C., Monsanto C.P.47414, S.940 and ultramised phenothiazine. Losses in the field from "Gainex" were investigated.

External Parasites.—Insecticidal efficiencies of a number of chemicals were tested against lice, and for longevity in the wool. Low concentrations (0.0005 per cent) of diazinon, nankor, asuntol and trithion were tested. Diazinon was the only satisfactory one at this low level.

In itch mite trials with the organic phosphate diazinon, malathion and trithion only a moderate kill was achieved. Rotenone gave good control. Imidazole was poor.

In co-operation with Division of Science Services Chemistry Branch this Section is to study the chemical changes and biological effects of mixing lime sulphur with each of several organic phosphates. Such mixture might save an extra dipping of sheep. Briefly: it appears that while the lime sulphur mixture is stable, and persists, the organic phosphates tend to break down in this alkaline medium within a few days.

Sheep Nutrition Research, Glenfield

Protein Levels at Maintenance.—Digestibility studies of diets fed in the group trials were continued, using small groups fed in metabolism cages.

Chemical analyses of the food and faecal material have been completed.

Addition of small amounts of lucerne chaff to cereal chaff increased the dry matter digestibility slightly. Digestibility was slightly reduced when straw was added to cereal chaff.

The second and last series of group trials will commence in September. Planning of the treatments is proceeding.

Digestibility Studies with Merino Rams (Plus and Minus Skin Folds).—Trials were conducted to observe whether nutrition had an effect upon the results obtained in a study comparing the fertility performance of "plus" and "minus" skin-fold Merino rams. Six rams of each type, in individual pens, were fed a diet of average energy and high protein content. Body weight, dry matter intake and faecal output were recorded. The results have not yet been statistically analysed. Variability within the two groups may have prevented the better performance of the "Folds Minus" group from being significant.

Nutrition Studies with a Heterocyclic Steroid.—Trials with the anabolic steroid, WIN 14,833, were continued. Merino weaners which received a massive quantity of 200 mg. of the steroid gained more body weight than did control weaners grazing with them. But the differences were not significant.

A further, perhaps final trial has been planned for July, 1964. It will be under grazing conditions, to allow greater body weight gain in six weeks.

Urea Blocks as a Source of Nitrogen.—Feeding of urea blocks of two different compositions was commenced in January, 1964 and concluded in June. Six groups containing eight Corriedale and eight Polwarth six-toothed wethers were hand-fed in yards. This was at Temora Agricultural Research Station.

Two groups were fed, *ad lib*, roughages of either medium or low protein content without any supplement. The medium and low protein roughages were respectively 5.2 per cent and 2.3 per cent crude protein. Two types of urea block were tested:—block A contained 30 per cent urea, 48 per cent sodium chloride, 10 per cent calcium carbonate, 3 per cent molasses and the remainder other salts; block B consisted of 6 per cent urea, 46 per cent sorghum grain, 30 per cent molasses, 14 per cent sodium chloride, and the remainder other salts. Both blocks were manufactured into large solid forms by heat fusion This permitted only gradual intake of the ingredients. The blocks were available continuously to the sheep.

Some of the results have been statistically analysed. When the medium protein roughage was fed, sheep given block B had significantly greater body weight gain and significantly greater greasy fleece weight production than sheep fed block A or sheep that were unsupplemented. Sheep given block A when fed the medium protein roughage showed similar results to the unsupplemented sheep.

The increased roughage intake of the group of sheep given block B and fed the low protein roughage was about 160 per cent., compared with an unsupplemented group. All sheep survived when fed the low protein roughage and given block B; 12 survived when given block A; and only five survivors remain in the unsupplemented group at the end of the 14 weeks' trial. The group given block B maintained body weight on the low protein roughage, but the body weight loss of surviving sheep fed either block A or unsupplemented was approximately 30 lb.

Further trials of these blocks will be planned when all of the results have been analysed.

Ram "Folds and Fertility" Research, Glenfield

Investigations from October, 1962, to March, 1963, suggested that rams from the Trangie "Folds Plus" selection flock were less tolerant of high ambient temperatures than were rams from the "Folds Minus" selection flock. From July, 1963, to June, 1964, two experiments have been conducted to test this hypothesis.

Experiment 1.—The semen quality of eight "Folds Plus" and eight "Folds Minus" rams was examined semi-weekly from June to September, 1963. All rams were approximately two years of age at the start. At the start of the fourth week four rams of each fold-type received a thermal burden; a gradual rise of ambient temperature to 40°C, over a period of three weeks.

The results indicated that "Folds Plus" rams are less tolerant of high ambient temperatures than are "Folds Minus" rams. Both the semen quality and actual fertility of the "Folds Plus" were seen to be lower than those of "Folds Minus" rams following a temperature stress. Thus the hypothesis established by earlier investigations has been fully supported.

The most interesting trend raised by the results is that the fertility difference of "Folds Plus" and "Folds Minus" rams is present despite similar testicular tissue temperatures in both groups. Furthermore, the temperatures are in the range considered "normal" for testicular tissue.

To test the possibility of chance association between "folds" and ram fertility in the Trangie "folds flocks" a group of rams was obtained from Cunnamulla "folds selection flocks", for "Experiment 2".

Experiment 2.—The semen quality of four "Folds Plus" and four "Folds Minus" rams from each of two locations, Trangie and Cunnamulla, was examined semi-weekly from December, 1963, to mid-February, 1964. During the third week a randomly selected half of each type of ram from each location received a thermal burden; an elevated temperature for a period of 56 hours. During this period the mean daily temperatures ranged between 35° and 45° C., and mean nightly temperatures between 15° and 25°C.

The results indicated the semen quality and fertility of "Folds Plus" rams from both Trangie and Cunnamulla to be lower than those of "Folds Minus" rams from each place. If subsequent analysis proves the results are significant it will be evident that the relationship between "folds" and ram fertility is not a peculiarity of the Trangie selection flocks.

SHEEP INDUSTRY RESEARCH, TRANGIE STATION (INCLUDING SOME CO-OPERATIVE WORKS WITH OTHER STATIONS)

Selective Merino Breeding for Production Characters

High Heritability of Fleece Weight and its Component Measurements.—Measurements of 15 months old ewe progeny from all experimental flocks have again demonstrated this high heritability. Results from the single-character selection groups emphasize the importance of the negative genetic correlation between clean-fleece weight and crimps per inch. The Selection Demonstration Flock is producing 4 per cent more clean wool than the registered stud. This demonstrates the success of a breeding plan based on measured characteristics.

For the first time, a full comparison of the reproductive performance of all flocks could be made. Among the commercial flocks, the Nucleus portion of the Selection Demonstration Flock and the Fertility Flock gave outstanding performances—respectively with 119 per cent and 112 per cent of lambs weaned to ewes mated.

An interesting problem involving a high percentage of dry ewes (more than 30 per cent) has appeared in the South Australian Flock. Among the selection groups the flock selected for high fold score performed very poorly. Flocks of high fleece-weight showed no tendency towards reduced lambing performance. The most fertile selection group was that selected for low weaning weight—42 per cent of twin births and 7 per cent of triplet births. It seems likely that automatic selection for multiple births has occurred during foundation of the flock.

Effect of Stud Feeding on Ram Performance.—The experiment examining influence of stud feeding practices on productive performance of rams has been carried almost to the completion of the shed feeding period. In April, 1964, the Stud feeding-plane group had an average body weight of 230 lb. as against 145 lb. for the pasture-fed controls. After completion of the production record, these rams will be progeny tested.

Anoestrus and Shearing Time.—Work evaluating the South Australian Merino has been concentrated on the problem of dry ewes to a March mating; defined as a problem of anoestrus which can be largely overcome by shearing the ewes prior to mating.

Further light has been thrown on this problem by Condobolin Experiment Farm results. There, South Australian and Peppin Merino ewes are being compared in first-cross lamb production. The first year's results showed marked interaction between Merino strain and season of mating; the Peppin ewes holding the advantage with March mating, whereas the South Australians are much superior with the November mating.

Formation of Lustre-wool Flock.—This has progressed to where the lustre gene is segregating within an 88 per cent Trangie genotype. Presence of the lustre gene markedly increased the co-efficient of variation of production characters.

"Shoulder Strip" Method for Ranking Rams on Fleece Weight.—A further experiment examining the value of this method has been completed. It confirmed the value of the method. One strip is just as valid as two, and 4½ months' wool growth is just as valid as 8 months.

Weaning-weight Selection Groups.—Analysis of selection progress in the flocks selected for and against weaning weight has shown close agreement between predicted and realised heritability. The 23 per cent heritability is high enough for good, though not maximal response from mass selection. Milk production measurements in these flocks have shown that selection for weaning-weight automatically increases milk production, without altering milk composition.

Influence of Selection on Efficiency of Conversion of Feed to Wool

An experiment utilising three levels of nutrition has given estimates of net efficiency of 1.08 : 0.95 : 0.80 for the "Fleece Plus" : "Fleece Minus" : "Random" flocks.

The response lines, graphing wool growth against feed intake, show that the low producing flock responds less as food intake increases. At an intake of 500 gm. per day, "Fleece Plus" produces 23 per cent more wool than "Fleece Minus". At 1,000 gm. per day, the difference is 40 per cent. This differential response has been confirmed with breeding ewes at pasture, using the natural stress of pregnancy and lactation as the means of producing different levels of wool growth.

Associated work under this project has also shown that the fleece-weight flocks differ little in voluntary intake of feed and in ability to digest feed.

Influence of Selection on Fertility

The first nine matings (1951-60) of the flocks selected for and against "fold" score have been fully analysed. Net reproductive rate of "Folds Plus" at 1.069 was only a little over half that of the "Folds Minus" flock at 2.099.

Preliminary investigations of the fluctuation in face-cover on weaners have shown changes of the order of 20 per cent over a period of two months. These changes could be associated with fluctuations in the nutritional environment.

Environmental Influence on Ram Fertility

A series of experiments has shown that the Trangie "Folds Plus" rams are less tolerant of high ambient temperatures than are "Folds Minus" rams, in terms both of semen quality and actual fertility. This difference was present despite similar testicular tissue temperatures in both groups of rams. These findings have been confirmed, using rams from the C.S.I.R.O. flocks selected at Cunnamulla, Queensland for and against "fold" score. (See also P. 55 under Glenfield research.)

Comparison of Two Management Systems for Lambing

Following further modifications to the drift lambing-system, excellent results have been obtained with the August lambing:—Eight per cent of losses between birth and marking (10 days), with a further five per cent of lambs disappearing between marking and weaning.

Losses were higher at the September lambing: 12 per cent to marking and a further eight per cent to weaning. The problems with the later lambing have been identified—predation by crows, and blowfly-strike of marking wounds.

Comparing lamb losses in the drifting system with losses in unsupervised, control flocks, it has been estimated that seven per cent of lambs were saved from the "South Australian Flock" and three per cent from the Stud Flock.

Dorset Horn versus Cheviot, Ram Comparison Trial

This experimental work was performed at the New England and Tamworth Agricultural Research Stations.

The Dorset Horn again proved superior to the Cheviot as a sire of prime lambs; seven per cent advantage at New England and eight per cent at Tamworth.

Comparison of good and poor type sires, within breeds, indicated overall that this classification had no relationship to to value of the lambs sired.

Effect of Poll Gene and Castration on Lamb Growth

In the final stage of this work, meat from ram and wether lambs was examined at the C.S.I.R.O. Meat Analysis Laboratory, Brisbane. The only significant differences detected by the panel were that wethers showed more "off and foreign flavours and odours" than the rams. These results showed no taste basis for price discrimination against ram lambs.

Border Leicester x Merino Fixation

The August, 1963, lambing was again very successful; 816 (F_1 to F_2+) ewes mated and 153 per cent of lambs tagged alive. F_1 ewes showed higher fertility than F_2 ewes. In contrast, only 16 per cent of lambs were tagged from the 100 ewes lambed in autumn 1964. In May, 1964, this project was reviewed and because of published results showing that a breed type, of no proven value, was already fixed, the project has been terminated at least in its present form.

Autumn, Spring and Dual Lambing Trial

The five years' data from this experiment have been analysed and published. Expressed in kg of liveweight of lambs produced per 100 ewes mated, the Dual-mated flock held a negligible advantage of two per cent over the March-mated flock; and a large, 38 per cent advantage over the October-mated flock. In the Dual-mated flock, the general trend was for two matings a year to occur only when the ewe was young and only when the ewes suckling lambs were mated in March. For maximum lamb production, it is suggested that maiden ewes could be joined in October, again in the following March and thereafter annually in March.

Hybrid Vigour in Lamb Production

Results of the first set of reciprocal matings between the Border Leicester and the Merino indicate either dominance or hybrid vigour. The crossbred lambs grow faster than the mid-parent average; 0.50 lb./day as against 0.45 lb./day. Growth rate of the lambs also indicated that the Merino ewe needs a high potential for milk production if she is suckled by a lamb with the genetic potential for rapid growth.

Effect of "Fold" on Production

The further year's results from field experiments examining influence of "fold" and face-cover on productivity have fully confirmed previous results. Full statistical analysis of this data has been commenced, starting with "fold" score.

In all flocks there was a significant positive correlation between "fold" score and greasy-wool production; ranging 0.25 to 0.40 in the flocks so far examined.

In one flock there has been a significant increase in percentage of down-graded fleeces, in association with increasing "fold."

In two flocks there has been significant increase in percentage of dry ewes as "fold" score increased.

TRANGIE STATION'S CO-OPERATIVE FIELD RESEARCH AND LIAISON WITH DISTRICT OFFICERS

From these research channels the following results have ensued: (1) shearing of spring drop lambs has been of little value in lamb production; (2) Poll Merino rams have not shown fertility superior to that of horned Merino rams; (3) a method of defining the causes of low flock lambing performance is being developed; (4) the performances of four professional sheep classers in grading stud ewes were examined, and showed a range 30 to 55 per cent efficiency by comparison with grading on the basis of measurements.

Research-Extension Liaison by Trangie Station

Special Seminars.—Seminars, concentrated mainly on sheep breeding problems, have been conducted in co-operation with the Department's sheep and wool officers and the C.S.I.R.O. Animal Genetics Section. These included: (i) a Trangie meeting of the N.S.W. Council of the Merino Breeders' Association, 8th November, 1963; (ii) a school for Commonwealth sheep and wool officers, 2nd to 4th March, 1964; (iii) a discussion group for private Rural Group Advisors, 10th-11th March, 1964; and (iv) a seminar for N.S.W. sheep and wool extension officers, 4th-7th May, 1964.

Graziers Meetings, and Schools.—A considerable amount of lecturing, about 40 hours, has been provided for graziers' meetings and short-term schools.

Fleece Measurement Extension Service.—This service for ram breeders has completed its first year. Reports have been furnished to 84 studs, covering measurements of 4,400 wool samples from reserve rams.

Agricultural Gazette Research-Extension Liaison Articles.—n co-operation with the sheep and wool extension officers, ho are doing most of the work, a series of extension articles being prepared for the Agricultural Gazette. These articles re based on published research from the Trangie Research fficers. Since December, 1963, a popular article of this ype has appeared in each issue of the Gazette. Also, since he advent of the "Research Section" of the Gazette in December, 1963, five "pars" dealing with the work of Trangie Research Officers have appeared. These "pars" have been written by the Research Liaison Officer, Division of Information Services, from material presented in the 1961-63 Annual Reports of the Wool Research Laboratory.

Sheep Industry Research at Leeton Station

Merino vs. (Border Leicester x Merino) Ewes for Prime Lamb Production

An experiment in which (Border Leicester x Merino) ewes and Merino ewes were compared was commenced in February, 1961. It has now ended.

Three years' results were obtained. The ewes were mated to Dorset Horn rams for six-week periods in each year of the trial. Observations were made on various characters of the ewes and their progeny: lambing performances, wool production, milk production of ewes, growth performances of lambs, and monetary returns of both wool and lamb.

Over the three years the crossbred ewes out-produced the Merino ewes in every sphere except in wool production.

There was no significant difference between the breeds in greasy fleece weight. There was, however, a highly significant "breed x year interaction" for greasy fleece weight, due to the fact that, in the first year of the trial, crossbred ewes cut more wool than Merino ewes. By the third year of the trial this situation had reversed, with Merino ewes cutting more wool than crossbreds.

Over the three years the average of returns per ewe mated, for wool and lambs, were: crossbred, £3 16s. 6d.; Merino, £2 17s. 10d.

Assessment of the comparative value of the Merino ewe as a prime lamb mother from these results has to be approached with caution. The results were outlined in the 1962-63 Annual Report. This cautionary note is emphasised by the significant "breed x year interaction" for greasy wool production, mentioned in the preceding paragraph.

There was also a similar significant "breed x year interaction" on growth rate of lambs. But in this case the growth rate of crossbred lambs was significantly higher in each year of the trial.

Effect of Pre-mating Shearing and Lucerne Feeding on Fertility of Maiden (Border Leicester x Merino) Ewes

In a previous experiment at this Station negative results were obtained when maiden ewes shorn just prior to mating were compared to ewes carrying four months' wool when mated. This contradicted overseas results. Therefore, the trial was repeated. Results of interest were as follow:—

(i) Autumn mating increased lambing percentage (by 37.2 per cent) as would be expected.

(ii) Lucerne feeding significantly increased the per cent multiple births by 11.6 per cent, but herein there was a significant interaction for time of lambing x type of feed. For the summer-mated ewes there was no significant difference for type of feed in per cent multiple birth. Most of the difference favouring lucerne-fed ewes came from the autumn-mating ewes.

While it is not necessarily concluded that lucerne feeding during flushing and mating is preferable to feeding on white clover-paspalum, the results do not agree with New Zealand results (Coop & Clark, 1960, N.Z. J. Agric. 3: 9-22). The N.Z. results showed reproduction to be depressed by feeding on lucerne pastures. This difference between the N.Z. and Leeton results could be due to differences in strain of lucerne and/or climate.

(iii) Shearing of ewes just prior to mating did not increase fertility, and actually depressed it. In the previous experiments at the Leeton station, where this same comparison has been made, shearing before mating did not cause any significant effect on fertility—although the figures favoured the unshorn ewes. It is concluded that pre-mating shearing will not increase fertility of Border Leicester x Merino ewes in this environment, and may actually depress it.

Effect of Time of Drop on Commencement of Ewes' Sexual Season

This trial is to study the effect of period of the year at which ewes themselves are born, on commencement of the sexual season. Four drop-groups of Border Leicester x Merino ewes bred at Yanco Agricultural Research Station were transferred at weaning to Leeton Station. These ewes are joined to harnessed teaser rams in mid-October each year and oestrus dates are recorded. Teasers are left with them until all or nearly all ewes exhibit oestrus.

The limited data so far available from this experiment are shown in the accompanying tabulation. It shows the average dates of first oestrus for each group in 1962-63 and 1963-64; also the approximate average age of each group in January, 1963 and 1964.

Date born	Average Date of First Oestrus 1962-63	Approx. Age January, 1963 (Months)	Average Date of First Oestrus 1963-64	Approx. Age January, 1964 (Months)
Spring 1961	3-3-63	15	10-1-64	27
Autumn 1962	24-3-63	8	7-1-64	20
Spring 1962	....	....	25-1-64	15
Autumn 1963	....	....	8-3-64	8

Differences so far observed could be due either to age of ewes or time of drop, or a combination of both. Differentiation between these two factors should be possible after the 1964-65 observations, as the ewes in all groups will then be mature. So far, however, the results show that:—

(ii) Twenty months old autumn-drop ewes commence their sexual season at about the same time as autumn-drop, twenty months old ewes. Whether this indicates that when ewes are mature, age and time of drop have no effect on commencement of the sexual season is not yet known.

(ii) Twenty months old autmn-drop ewes commence their sexual season before fourteen months old spring-drop ewes. Whether the important factor herein is age or time of drop, or a combination of both, is not yet known.

(iii) Fifteen months old spring-drop ewes commence their sexual season considerably earlier than eight months old autumn-drop ewes. Herein the relative immaturity of the autumn-drop ewes is almost certainly the factor responsible.

Effect of Management on Commencement of Border Leicester x Merino Ewes' Sexual Season

This trial aimed to compare the commencement time of the sexual season of ewes respectively set stocked or rotationally grazed. The two groups of ewes were grazed at equal stocking rates from August, 1963, to January, 1964 and joined to harnessed teaser rams in mid-October.

One group was set stocked and the handling of these ewes was kept to a minimum. The only handling involved drenching with carbon tetrachloride at two monthly intervals. Oestrus observations were made without handling them.

The other group was rotationally grazed through four paddocks at weekly intervals and taken to the sheep yards fortnightly for weighing. These ewes were rounded up three times weekly with sheep dogs, for oestrus observations.

The rotationally grazed ewes mated two weeks earlier than set-stocked ewes. So, in this case, handling actually stimulated rather than depressed the occurrence of oestrus.

Observations on Sexual Season of Border Leicester x Merino Ewes in Three Environments

Effects of management and environment on sexual season of Border Leicester x Merino ewes are being studied in a trial conducted with the co-operation of two Murrumbidgee Irrigation Area farmers. The two properties adjoin, and each runs Border Leicester x Merino ewes for prime lamb production. Ewes are joined to Dorset Horn rams in October. Joining at this time has been consistently successful on Farm A for years; but on Farm B the ewes have usually failed to mate until December-January.

A group of 300 Border Leicester x Merino ewes born late in winter 1961 were purchased from the central west of New South Wales in May, 1962; divided at random into three groups of 100 and placed on Farm A, Farm B, and Leeton Station. This transfer took place in May, 1962. Results for the joinings of the ewes in 1962-63 were given in last year's Annual Report.

The ewes on each of the three places were joined to harnessed Dorset Horn rams on 2nd October, 1963. Liveweight of ewes at this date were—Farm A (112 lb.); Farm B (144 lb.) and Research Station (102 lb.). Percentage of ewes marked by rams at the end of October were: Farm A, 24 per cent; Farm B, 1 per cent; and Research Station, 35.8 per cent. (Differences all statistically significant.)

The most surprising feature of these results is that the ewes on the Research Station actually mated in October, and earlier than the ewes on Farm A. In contrast, other ewes on this Station generally did not commence to mate until late November, or in December or January.

Oestrus occurred generally on Farm B in November but the ewes mated about 2-3 weeks later than the ewes on Farm A and the Research Station. This was despite the excellent condition of the Farm B ewes at and during joining.

No explanation is offered for the differences in commencement of the sexual season on the three properties.

Feed Intake of Early Weaned and Suckling Lambs

Ten (Border Leicester x Merino) x Dorset Horn wether lambs born in September, 1963, were selected at six weeks of age so that they were of comparable age, birth weight and growth rate. On 11th November, 1963 (8 weeks of age) half the lambs were weaned by removing their mothers from the experimental group.

Determinations of pasture intake by the chromic oxide-faecal nitrogen technique were carried out on all at 9, 12 and 16 weeks of age. Milk production of the ewes was measured by the oxytocin method before and after each pasture-intake determination. Ewes and lambs were set-stocked on a paspalum-white clover pasture for the duration. Lambs were weighed and growth rates recorded.

Chemical analyses are not yet complete. But preliminary figures indicate that dry matter intakes of the weaned lambs were higher than those of the suckling lambs, at 9, 12 and 16 weeks of age, by 75 per cent, 19 per cent and 16 per cent respectively.

CATTLE RESEARCH, VETERINARY STATION, GLENFIELD

Veterinary

Serological Survey of Bovine Brucellosis and Q Fever in Cattle and Sheep.—The 12 months survey has recently been completed on stock slaughtered at the Homebush and Newcastle abattoirs. Twenty sera from each species of animal has been collected at monthly intervals from each abattoir; in the study of the number of zoonoses in abattoir workers and to determine the incidence of brucellosis and Q fever infection in cattle and sheep. Assistance with Q fever tests has been provided by the School of Public Health and Tropical Medicine and the State Health Laboratory at Lidcombe. The results are now being analysed.

Ill-thrift in Beef Cattle.—Trials with Hereford cattle continued at Hartley. In the twelve months trial, young animals exposed to liver fluke and *Ostetagia* infections but treated with anthelmintics put on more weight than the untreated. The best response was in groups treated with thiabendazole and hexachlorethane once a month. Regular blood examinations showed normal copper and phosphorous levels. No significant response occurred in animals given cobalt and selenium.

A further trial was commenced in December using, on groups of twelve, spring drop calves still suckling. Monthly weighings, faecal examinations and treatments will determine the effect of parasites on growth rates, especially in young animals weaned in the autumn. In one group, only the mothers are treated; the aim being to increase milk quantity and quality for their calves.

Leeton and Armidale results were not highly significant. The groups were small, the animals old, and the anthelmintics used were not very efficient against the implicated parasite (*Ostertagia ostertagi*). The tentative conclusion was that ill-thrift in beef cattle is a complex condition produced by such factors as inadequate nutrition and internal parasites. The part played by parasites, roundworms and flukes, depends on their numbers, and the resistance of the host—largely dependant on age.

A severe outbreak of ostertagiosis in Hereford cattle in the Armidale district is now being investigated. *Ostertagia* is severely affecting other cattle in this district. During the examinations the species *O. lyrata* was identified for the first time in N.S.W.

Internal Parasites.—No new chemical was tested for anthelmintic activity in cattle but eight Aberdeen Angus steers were dosed at high rates with haloxon. At eight times the therapeutic dose, and more, a delayed irreversible neurotoxicosis was produced in all animals. This condition had previously been described overseas.

The trials with a molasses phenothiazine lick at Camden Park were concluded. These very young heavily parasitised calves showed a good response although feed intake was not controlled. To supplement this work, three calves were given small doses of phenothiazine daily for six weeks in a small trial at Glenfield. Egg production and larval development were each suppressed, by comparison with the controls.

A survey is being conducted in association with the Commonwealth Department of Primary Industry to determine *Cysticercus bovis* incidence in this State. Specimens forwarded by inspectors at the various abattoirs have been examined. To 4th June, 1964, three positive cases have been found from 18 suspects submitted. A positive diagnosis was made only in cases where a recognisable cysticercus was seen, but probably others were positive. All three cases came from the North Coast district.

The Australian Cattle and Beef Research Committee has granted funds for a long term project to investigate epidemiology and control of internal parasites. The first phase involves an epidemiological survey to determine the importance and seasonal fluctuation of numbers of helminth parasites and coccidia in cattle in various parts of N.S.W.

Bloat.—A small trial was conducted to test claims that a grazier in the Forbes district had controlled bloat by feeding a supplement to beef cattle grazing irrigated lucerne and white clover pastures. The supplement comprised two parts salt, two parts powdered molasses, two parts peanut meal and two parts ground limestone. This was of particular interest because of current theories on the possible role of salt intake in preventing bloat.

The mixture was unpalatable to cattle at the Veterinary Research Station. They could not be induced to eat it, even when mixed with their normal dairy meal, until the salt level was reduced to about 5 per cent.

The milking herd of 32 cows was grazed on a known risk pasture (three dead and twelve advanced cases, two days previously) and divided into two groups on the basis of "bloat susceptibility". One group was fed the modified supplement and the other the normal dairy meal. Both groups were equally affected at all subsequent grazings over a period of six days.

Milk Fever.—Practitioners in certain areas have reported increasing numbers of cases that do not respond to treatment, or that suffer relapse.

In co-operation with University personnel and two practitioners, the problem is being examined by determination of calcium, magnesium and phosphate status of affected cattle before initial treatment and any necessary retreatments. The results are being correlated with a standard clinical report on the affected animal and the prevailing climate and environmental conditions.

Of a series of twelve so far examined, one sample only has been severe uncomplicated hypocalcaemia; two have been associated with mild-severe hypomagnesaemia, and eight with hypophosphotaemia.

The samples received for this work will also be examined for serum electrolyte balance.

BEEF CATTLE RESEARCH, LEETON STATION

Pasture Intake and Digestibility Studies

The seasonal growth pattern of cattle grazing irrigated pasture in this environment has been studied. The work has shown cattle performance to be sub-optimal at some periods of the year, even with apparently adequate pasture available. The reason is not yet clear. A number of factors, including deficiency of cobalt, copper, and/or potassium and the effects of internal parasites have already been eliminated.

Pasture intake and digestibility studies commenced in August, 1963, aim to determine whether actual nutrient intake is limiting animal performance. The initial phase is establishment of faecal nitrogen-digestible organic matter regressions, using sheep in metabolism cages.

A series of digestibility runs has been completed on the irrigated *summer* pastures (paspalum and white clover). The irrigated *winter* pastures (Wimmera ryegrass and sub. clover) are now being studied, to cover the whole year.

Following the digestibility and intake studies commenced ast year at the Station, there have been further trials and others are proceeding—to complete the seasonal digestibility co-efficient and digestible organic matter intake (DOMI) for cattle on both summer and winter pastures.

Since September, 1963, two shed trials and four paddock (free grazing cattle) trials have been completed. These were all on paspalum-white clover summer pasture at various stages of maturity and botanical gradation. One of the shed trials compared quantitative DOMI and faeces output, using faecal collection apparatus (after Ballinger and Dunlop), to the estimated DOMI from the chromic oxide marker technique.

Further intake and digestibility studies of cattle grazing improved winter pastures (Wimmera ryegrass and sub-clover varieties) have been started. A present trial compares cattle grazing short and long pastures. The animals' subsequent intakes, similar and dissimilar, will be estimated from the information gained from chromic oxide dosing and from digestibility figures achieved by sheep fed on pasture in cages. This last mentioned trial is of a factorial design to help complete the information on the sub-optimal growth rate of Station-bred and introduced cattle.

Laboratory analyses and the results on all shed and field trials will shortly be available. Preliminary figures indicate a high order of accuracy in the chemical determinations.

Beef Production per Acre Experiment

This experiment has ended. The overall results of the three production years (1960-61, 1961-62, and 1962-63) are summarised in the accompanying tabulation (p. 59).

In terms of quantity and quality of beef produced, maximum production per animal (248 lb.) was achieved at the lightest stocking rate (1 per acre).

Maximum per acre production came from the heaviest stocking rate (2 per acre). But this was at the expense of quality. There was some down-grading of carcases due to lack of finish. Stock valuations also reflected this trend.

A growth pattern similar to that shown by stock grazing generally round the Station was shown by the steers in this experiment. However, at the used proportion (1 : 2) of summer to winter pasture there was inadequate summer pasture. This would account in part for the slower growth and fattening during this period.

Winter-Spring Weight Increase Performance

The winter liveweight increase of the rotationally grazed Angus weaner steers (previous paragraphs) had been consistently slower than that of Hereford yearling steers set-stocked on other winter pasture areas on the Station. To ascertain reasons, a multi-factorial (2x2x3) designed experiment was undertaken.

The treatments were:—Two classes of stock (Angus weaners v. Hereford yearling steers), two management systems (set and rotationally grazed), and the three areas re-randomised (paddocks D. H. and K). Fifty-six steers were allocated to the areas from 13-6-63 to 4-12-63 at a stocking rate of 1.7 beasts per acre. Stock were weighed, valued, condition-scored and carcase-appraised.

Preliminary analyses show no differences between any of the treatments.

Irrigated and Dry Land Grazing Compared

The heavier stocking rates generally practised under irrigation usually ensure greater production per acre than does dry-land pasture. However, it is often claimed that stock thrive better under dry-land grazing. To obtain some factual information on this, comparable steers were grazed on dry-land pastures at Yanco Agricultural Research Station and on irrigated pastures at Leeton Agricultural Research Station. The experimental grazing period was from 13-6-63 to 4-12-63.

On the improved dry-land and irrigated pastures there was no clear difference in liveweight gain, carcass gain or valuation. However, statistical analysis may show the improved dry-land pasture to have some advantage, particularly in bloom and finish of stock.

Internal Parasites in Cattle

To examine the efficiency of hexachlorethane against liver and stomach fluke a trial was undertaken on 12 Angus weaner calves. Four days prior to slaughter on 26-7-63 half of these were drenched with the standard dose rate (200 mg/kg.). At this dose, hexachlorethane proved 100 per cent efficient against mature Paramphistomes and 96 per cent efficient against Fasciola. As a result, the dose rate for routine cattle drenching at Leeton Station has been increased by 25 per cent.

Ultrasonic Measurement of Fat Thickness in Live Steers

Ultrasonic measurements were made on twelve steers just prior to slaughter. The measurement of back fat thickness was closely related to actual measurement on the carcass. With further experience of the instrument it could be a useful tool in assessing degree of finish in the live animal. The instrument used was a Smith's Ultrasonic Pig Grader, brought to the Research Station for the purpose by S. Smith & Sons Pty. Ltd. of Granville.

CATTLE NUTRITION RESEARCH, WOLLONGBAR STATION

Feed Year Production Trial

In collaboration with Division of Plant Industry, production by dairy cows under two different systems is being compared. The first system is that generally practised in the district, whereby cows calve in July and August and are maintained entirely on unimproved grass pasture. In the second system, legume species have been introduced into the grass pasture to provide high quality supplementary feed. The species introduced have been the summer growing legume *Glycine javanica,* and two winter growing legumes Clare subterranean clover and *Vicia sativa.* Under this system, cows are calved in December and January to take advantage of the seasonal nature of the pasture species.

Progress results indicate that production per acre will be approximately 60 per cent greater under the second system.

Pasture Intake and Digestibility

Feeding trials have been carried out to determine the digestibility of dry matter, and the energy, crude protein and fibre of individual pasture species and mixtures at various stages of growth. (Wethers were the test animals.)

Summary of Results of "Beef Production/Acre" Experiment

Stocking Rate/Acre	Year	Liveweight Gain		Carcase Gain			Export Grade (Per Cent of Carcases)			Value/Head (£)		Return/ Acre (£)
		Per Head (lb./day)	Per Acre (lb.)	Per Acre (lb.)	Per Head (lb.)	Per Acre (lb.)	1st	2nd	3rd	Initial	Final	
1	1960-61 1961-62 1962-63	1·32 1·16 1·32	402 408 463	402 408 463	235 249 261	235 249 261	. . 100 100	. . . . . .	. . . . . .	30 21 13	50 33 36	20 12 23
	Average	1·27	424	424	248	248	. .	. .	. .	21	40	18
1½	1960-61 1961-62 1962-63	1·12 1·04 1·13	340 365 396	510 548 594	185 210 206	278 315 309	. . 83 50	. . 17 50	. . . . . .	30 21 13	45 29 31	23 12 27
	Average	1·10	367	551	200	301	. .	. .	. .	21	35	21
2	1960-61 1961-62 1962-63	0·98 0·85 0·97	298 300 339	596 600 678	137 176 168	274 352 336	. . 67 50	. . 33 38	 12	30 21 14	42 28 31	24 14 34
	Average	0·93	312	625	160	321	. .	. .	. .	22	34	24

The work has given the following indications:—

(i) Provided a legume has been grown in the paddock from which kikuyu grass is harvested, this species maintains relatively high digestible dry matter coefficients (65 to 70 per cent) until at least the end of June. Crude protein content will be in the range 12 to 14 per cent under these circumstances. However, the digestibility of dry matter in kikuyu grass carried over the winter to early spring, and before fresh growth occurs, falls to about 50 per cent. Crude protein levels are then about 7 per cent dry matter.

(ii) *Paspalum dilatatum* has been tested only as winter carry-over feed or as mature pasture at the end of February. In each case digestibility of dry matter is about 50 per cent and the crude protein content is 5 to 6 per cent.

(iii) *Trifolium subterraneum* and *Vicia sativa* show about 75 per cent digestibility of dry matter, with crude protein content ranging from 23 to 30 per cent. The digestible dry matter of *V. sativa* falls to about 63 per cent after flowering, but crude protein remains high at about 20 per cent. The digestibility of crude protein in these species has ranged from 79 to 80 per cent.

(iv) The summer growing legumes *Glycine javanica* and *Desmodium uncinatum* do not possess the same high digestibility of dry matter nor the crude protein content of the temperate legumes. Digestibility of dry matter in the actively growing *Glycine* ranges from 60 to 65 per cent and in *Desmodium* from 54 to 57 per cent. Crude protein content of both species ranged from 15 to 20 per cent of the dry matter.

CATTLE TICK RESEARCH

By Wollongbar Cattle Tick Research Station

Tick Ecology.—Observations on six exposure sites indicate that a north easterly slope with pasture is very favourable to ticks. This makes patches of country about Lismore as suitable for them as much country north of Brisbane.

Contrary to forecasts which followed Brisbane research, the winter break in tick development in favourable situations is short. Ticks exposed in April, May, June and July all succeeded in producing some larvae though the hatchings for May and June were small.

It is now clear that patches of country very favourable to ticks must exist for many scores of miles south of Grafton.

Longevity of Ticks.—The longest period from dropping of the adult tick to the disappearance of the last larvae has been just over 224 days. The periods for which the six sites have been under observation have varied from 12 to 27 months. The totals of ticks exposed for the past year have been 252 per 2 weeks rising to 252 per week in the important seasons (spring and autumn).

Thus there is very strong evidence that the breakdown of the 1956-57 eradication campaign could not have been the result of tick larvae surviving the campaign in the non-parasitic stage.

Detailed weather records have accompanied the tick life history studies. It seems feasible that within two years from now the increased knowledge will enable any patch of coastal country south of the present tick areas to be classified for suitability to ticks. This will be by using a simple instrument such as a soil thermograph.

Acaricide Studies.—All of the most promising acaricide formulations available have been closely studied. Under the severe conditions of these tests, several modern formulations were found to be superior in some ways to arsenic and D.D.T.—the only ones used in New South Wales up to and including the failure of the 1956-57 eradication campaign.

The most promising formulation is sevin cattle dip. It has been through three trials at the Station and been studied in the field during the dipping of over 20,000 head of cattle. Well over 1,000 analyses of sevin fluid or residues have been performed by the Analyst. Sevin, when fresh, comes close to the ideal of being highly fatal to ticks and harmless to cattle.

Dipping of Travelling Stock.—Regulations require three dippings at intervals of three to seven days for cattle moving to clean country. Station trials suggest that with some mixtures three dippings at three-day intervals may not clean the animals and that this may have been an important factor in the breakdown of the 1956-57 eradication campaign.

Wetting of Cattle.—The attempt to wet completely the heads of dipped cattle: Experiments attempting complete head wetting show that complete wetting of cattle in the routine dipping procedure is extremely difficult and perhaps impossible. There is evidence that complete wetting of every beast may not be required for eradication of ticks.

By Board of Tick Control Laboratory

Wettability of Acaricides.—Work was undertaken with various acaricides to determine depositing power and wettability in relation to strength of the acaricide and also degree of contamination with mud. The results indicated that:—

(i) the addition of mud decreased wettability of delnav, trithion, diazinon and sevin but only slightly decreased wettability in the case of asuntol powder and asuntol emulsion;

(ii) the addition of mud increased the deposit of delnav and trithion and decreased the amount deposited in the case of diazinon and sevin. Little change was noted with asuntol powder or asuntol emulsion;

(iii) increase in concentration increased wettability in the case of delnav and trithion; slightly increased the wettability with sevin; but had little effect on the wettability of diazinon and asuntol powder, and showed a slight depreciation of wettability with asuntol emulsion.

Settling Rates of Acaracides.—Stirring and Settling Rate tests were undertaken with ethion and sevin. With ethion the settling rate was very slow, a fall of 10 per cent. in 80 minutes, whereas with sevin the concentration fell from 0.3 per cent to 0.175 per cent over a period of half an hour. This latter result is comparable with that recorded with D.D.T.

Stirring tests indicated that in both cases it was necessary to use 10 head of stirrers after the dip had been manually stirred.

Deposition of Acaricides in Hair.—Observations of hair deposits were made in respect of ethion, diazinon, delnav, sevin and asuntol emulsion. Results indicated not more than three days protection against reinfestation.

It was further demonstrated that in dipping large mobs of cattle the deposit in the hair was significantly greater in the first cattle dipped than in those dipped at the end.

Pesticide Residue Studies.—Use of gas chromatography was extensively studied for investigational work in respect of diazinon, delnav, ethion, trithion, D.D.T. and B.H.C.—and other materials that might be found in meat and dairy products as residues.

Further efforts were made to develop methods for estimation of hexachlorophene in fats. The work has been held up whilst awaiting a requisitioned ultra-violet recording spectrophotometer.

Work has also been undertaken on the micro-estimation of chlorinated hydrocarbons by oxygen flash combustion.

Micro-estimation of tissue residues of delnav and diazinon have been made, with the following results:—

	Sub-cutaneous Fat mg/kg	Kidney Fat mg/kg
Delnav—		
1 day after dipping	0.24	0.47
4 days after dipping	0.825	0.85
7 days after dipping	0.3	0.5
Diazinon—		
1 day after dipping	2.7	1.2
4 days after dipping	0.8	0.7
7 days after dipping	0.5	0.4

Two trials were undertaken to determine residues in dairy products, as follows:—

Delnav—

Composite cream samples were collected and analysed prior to and after dipping, with the following results:—

Prior to dipping—nil; 1 day after dipping—0.8 mg/kg; 2 days after dipping—0.3 mg/kg; and 4 days after dipping—0.5 mg/kg.

Diazinon—

For a spraying trial (undertaken at the Veterinary Research Station by Geigy Ltd.) the milk samples were analysed at the Tick Board of Control laboratory. Animals sprayed with 0.1 per cent. diazinon showed 0.038 mg/kg diazinon, and animals sprayed with 0.05 per cent. showed 0.021 mg/kg diazinon.

During the year 22 butter samples and 242 fat samples were analysed; the butter samples for D.D.T. content and the fat samples for both D.D.T. and B.H.C. The butter samples were entirely free from D.D.T. Most fat samples were free of both D.D.T. and B.H.C. but a few contained up to 3 mg per kg. D.D.T. and up to 20 mg mg/kg B.H.C. The source of the contamination is not known.

PIG RESEARCH, VETERINARY STATION, GLENFIELD

Swine Fever

Survey for Reactors.—Experimental observations commenced in the previous year were continued on pigs in three herds. In none of the three herds was it possible to recover swine fever virus from sick or dead animals or from the foetal membranes of reactor sows.

In one of the three herds, where reactors were retained, there was no evidence of new reactors during the 12 months.

In the second herd, from which reactors were removed, the entire 200 pigs were blood tested every two months. No fresh reactor was detected during a period of eight months. But at the tenth month 48 reactors appeared. This was most unexpected. It may have resulted from introduction of the virus or sensitizing agent by seagulls. These fed regularly with the pigs.

In the third experimental herd, reacting and non-reacting sows and a reacting boar were maintained intensively as a separate unit. There was no spread of gel test reactors to the negative animals during the 12 months. The progeny of reacting sows were tested weekly and all reacted after suckling. The reactions persisted in individual suckers for 37 to 86 days, and by then all had returned to negative.

Viability of the Virus in Pig Products.—This work was continued. Unsalted sausage casings contained viable virus on the first but not the third day after processing. Salted casings contained viable virus on the eighth but not the seventeenth day after processing. Processed hams held at room temperature did not contain viable virus after 26 days but when held in the cool room at 38°F. the virus was demonstrated up to 58 days after processing but not after 71 days.

Gel Diffusion Precipitin Test.—This year 2,501 sera were submitted to the gel test, mostly confined to animals in experimental herds and to surveys of pigs and other animals.

Reactors to the swine fever gel test were demonstrated in all bovine herds where more than four animals were sampled. This suggests widespread incidence of non-clinical mucosal disease-virus diarrhoea infection in this State's cattle.

Some 78 sheep sera revealed 33 reactors. Two of 75 goat sera also reacted. Reactors were not detected in the limited number of horse, dog and human sera submitted.

PIG HUSBANDRY RESEARCH, WOLLONGBAR AGRICULTURAL RESEARCH STATION

Pig Carcase Studies

In the course of assessment of carcase quality, it was found that marked differences in order of merit resulted when carcases were appraised by the Hammond and the Downey systems. In view of this discrepancy, work commenced in the previous year on the dissection of carcases was continued. The work was undertaken to obtain a more objective assessment of carcase quality.

These studies have indicated that as feeding is increased the percentage of muscle in the carcase is reduced. A high degree of association was found between percentages of muscle and percentage of fat. Increasing levels of feeding are thus associated with increasing percentage of fat.

Milk Production in Large White Sows

As there appears to be no records available of the lactation performance of Australian sows, the milk yield of three littermate sows in their first three lactations was determined. Production levels were equivalent to the best recorded in overseas studies. Overall mean daily milk yield was 13.8 lb. and for the third litter 16.3 lb. During the trial, intake of supplementary diet by the litter was low. The need therefore for high yielding sows for a full 56 day lactation is questioned, as it appeared that sow milk merely replaced intake of supplement. High yields would be of value for the first 21 days to ensure rapid early growth. There is a strong positive correlation between 21 day piglet weight and subsequent supplementary diet intake and thus 56 day weaning weight.

POULTRY RESEARCH, SEVEN HILLS STATION

Meatmeal Investigations

(1) *For Chickens.*—Evaluation of laboratory tests of meatmeal quality has proceeded. No simple laboratory test in current use has any value in predicting the feeding value to chickens, although the tests may indicate differences between the raw materials and meatmeal processing conditions. Much of the difference in feeding value between samples of meatmeals was found to be produced by the bone fraction.

Another investigation established that much of the variation in feeding value of meatmeals for chickens was removed by equalising the calcium levels in the chicken test diets. This suggested that other factors which might influence quality of the meatmeal (processing differences, species or age of animals, etc.) were unimportant by comparison with the effect of the calcium level of the diet.

(ii) *For Laying Hens and Breeders.*—Six samples of meatmeals producing widely differing weight gains in chicken diets were compared in diets for laying hens and breeders. No significant differences were observed in egg production, breeding performance or early chick growth. This supported earlier results, suggesting that laying hens are relatively indifferent to quality of the meatmeal even when meatmeal is the major protein concentrate.

Ranking of meatmeal samples by laying hens was observed to be similar to that by chickens in diets with equalised calcium and protein levels. This suggested that a factor in protein quality might be responsible for the small non-significant variation observed.

Choline in Chicken Diets

Investigations confirmed that addition of supplementary choline to chicken diets containing as low as 450 mg. choline/lb. does not increase weight gain. This indicated that the choline requirements of chickens fed typical Australian diets, are considerably lower than that of chickens used in overseas laboratory investigation. Further work is planned in this project.

Sex Linked Lethal Gene

From the broiler stock a lethal gene or gene-grouping in the sex chromosome has been identified and described. Linkage with other more desirable factors makes this gene dangerous. It could be readily spread through a flock during selection. Further study is planned, using a separate flock of birds, while the mutant itself is being eliminated from the selection flock.

Nutrition and Egg Quality

Evaluation of commercial yolk-pigmenting materials was undertaken this year. Lucerne meal, being in short supply and very variable in quality, has been an unsatisfactory source for general use. Synthetic carotenoids were examined and the manufacturers' recommendations were supported in general principle.

Effect of type of meatmeal on keeping quality of eggs was re-evaluated in an extensive egg production and storage trial. Distinct differences in rate of loss of albumen quality in storage were noted, in agreement with previous results. A further experiment has been undertaken, to see if phosphate level of the diet might be the determining factor.

The Livestock Husbandry and Advisory Sections of Division of Animal Industry

These Sections, each controlled by a Principal Livestock Officer, are: Sheep and Wool Section; Beef Cattle, Horses and Goats Section; Pig Section; Poultry Section; and Apiculture Section.

They provide the categorised, District livestock officers for extension services and the livestock officers for husbandry of the Department's studs, herds and flocks at the Research Stations and Agricultural Colleges.

THE SHEEP AND WOOL SECTION

Staff

Fluctuations.—The establishment was increased by one new position and now comprises 37 livestock officers. Four positions are vacant. Resignation of nine officers and one secondment occurred. The high rate of resignations is of serious concern.

In-Service Training.—Four sheep and wool officers attended the Departmental Extension Methods School, seven attended the Commonwealth Sheep and Wool Officer's Refresher Course, and eight the Departmental courses in Farm Management. Also, junior officers were given periods of training with District livestock officers.

Extension Activities

Tabulated Summary.—Following is a summary of activities:—

Number of property visits	2,904
Number of sheep selected	350,067
Number of flock ewes fleece-weighed	72,930
Value of stock selected for purchase	£146,822
Lectures, demonstrations and field days	277
Ram sales, agricultural shows, etc., attended	126
Radio broadcasts, publicity releases	447
Competitions judged	36
Field Investigations	29

The District sheep and wool officers also participated in Departmental research by supervising projects sited on private properties.

Fleece Measurement Gains.—Shift of emphasis in type of advice sought has been notable, especially in the increasing demand for selection using fleece measurement. There are now 82 studs using the fleece measurement service, an increase of 9.2 per cent on the previous year.

Increased Rate of Publications.—A system to increase the proportion of sheep industry articles in the Agricultural Gazette of New South Wales has been introduced. Decentralised officers are preparing extension articles from research papers. Three of these articles have been published during the year and three more are at the printery. Manuscripts of four others are back with the authors for final attention and two more are at Head Office for comment. Thus 12 papers have been prepared in 1963-64. These are in addition to papers prepared by Head Office staff of the Section. The aim is continuity of pastoral-interest material in the Agricultural Gazette.

Merino Ewe Competition Altered.—This competition has been conducted for about 35 years on basically similar conditions. The 1964 competition has been altered to allow the entry of ewes showing not more than four teeth and of one year's drop. Further, the remainder of the competitor's ewe drop, less normal culling, is inspected and awarded points. The new system covers spring, autumn and dual lambing and avoids the opportunity for a breeder to feed-up a team. Also, it provides that a new group of sheep will be inspected each year.

Lamb Breeders' Ewe Fertility Competition.—This competition has been commenced in its new form, judging by measurement. It shows signs of being a valuable demonstration in production by measurement.

Local Competitions Judged as Extension Media.—District livestock officers were involved in judging various types of competitions run by local organisations. These were used as extension service situations.

Liaison with Oher Services.—The Junior Farmer movement, Department of Education, was assisted by judging their competitions and projects, and by lectures and demonstrations.

Periodic visits were made by the Wagga sheep and wool officer to the Mannus Re-Afforestation Camp, Tumbarumba, to advise on management and husbandry of the sheep flock.

Estimates of the forthcoming wool clip and the number of sheep and lambs to be shorn were compiled for the Bureau of Agricultural Economics, Canberra, by the District officers.

Sheep Industry Production Trends

Heavier Wether-Stocking.—High wool prices are having a further effect on the industry, namely in wether-grazing. Recently published work has given impetus to heavier stocking. Some graziers are carrying at higher stocking rates than is accepted district practice. There is still a cautious approach in general but many have one and a half to twice their former numbers though not yet prepared to attempt higher multiplications.

Spring Lambing Trend.—The trend to spring lambing has continued and with it, to a lesser degree, a trend to autumn shearing. In part the approach to autumn shearing reflects graziers' desire to mate off-shears rather than with nine months wool. Another factor is the opportunity it provides for wool to be sold in the final sales of the year when spinners' wools are the main types offered.

Northern Tablelands Lamb Production.—A trend to lamb production continued on the northern tablelands. A number of British breeds studs are being established there. At one time the area was noted for its fine wool production. Fine wool is still produced but the advent of pasture improvement has opened up prime lamb production.

Increased Fleece Measurement.—Merino studs are displaying greater interest in fleece measurement. Until very recently this selection aid was regarded with antipathy.

BEEF CATTLE, HORSES AND GOAT SECTION

Staff

The establishment strength of this Section is 15 officers. There is one vacancy. Four appointments and one resignation occurred this year. Three officers were assigned to the Northern Territory for a year's further training.

Extension Activities

Summary.—The District beef cattle officers used group and mass media as well as visits to individual farms. They used field days, meetings, press releases, radio and television.

Eleven schools for beef cattle raisers were conducted.

Officers judged cattle at thirty Agricultural shows, and participated in the state wide judgings of the Beef Cattle Breeders Competition. The latter attracted 224 entries. The judgings were used well as extension service field day situations.

Ten demonstrations financed by the Agricultural Extension Grant are in progress.

Liaison with Research and Other Bodies.—Several officers of the Section are members of committees and organisations concerned with matters of research, extension and production; including Show Societies, Junior Farmer Clubs, the Beef Cattle Research Programme Committee, the Technical Sub-Committee on Beef Cattle Production, the North Coast Cattle and Beef Research Liaison Committee, and the research committees framing and directing projects at Agricultural Research Stations.

The Principal and three livestock officers are members of a committee responsible for the "Beef Cattle Improvement Through Breeding Methods" project centred on Trangie Agricultural Research Station. There, extensive improvements have been undertaken, including new cattle yards, feeding stalls and a feed storage shed. This project has been in operation for a year. The first year's operations will be completed by holding early in the new financial year an auction sale of yearling bulls, the product of the demonstration.

Departmental Stock

Departmental stud beef cattle totalled 546 at the commencement and 537 at the end of the 12 months. Stud stock disposed of comprised 24 bulls and 14 cows and heifers, to a total value of £6,971.

Commercial cattle in Departmental herds totalled 853 at the end, in comparison with 799 at the start of the 12 months. Commercial cattle sold totalled 204, for a return of £6,234.

Horses owned by the Department declined in numbers, from 225 at the start to 194 at the end of the 12 months. Sales totalled 38 head, for £3,271.

Beef Production Trends

Favourable Markets.—Except for brief isolated periods beef tle markets have been favourable. Demand for beef for e export trade, also the operation of interstate buyers and buyers from other parts of New South Wales with surplus ed, have kept prices evenly high. The few store cattle casionally available were eagerly sought. Confidence has evailed in the industry throughout the year. Yardings and lings in almost all centres have been high.

Trend to Breeding.—The increased turn-off of beef is mostly e outcome of a changeover from fattening to breeding actices. Breeding practices have assumed new status, in-uding changed farm practices and provision for supplementary eding.

All officers have been impressed by greatly increased de-and on them for assistance in selection of breeding stock. he growth of interest in pregnancy diagnosis has been sig-ficantly pronounced.

The trend towards increased pasture improvement for cattle ising continued, particularly on the tablelands.

Breed societies are becoming notably more active in pas-ral districts, offering incentives to breeders and sponsoring les of pure-bred young bulls and females.

Influence of More Abattoirs.—The opening of more abattoirs as been an encouraging development.

As an example, in the ten years from 1953 to 1963 grown attle slaughterings at the Northern Co-operative Meat Co. Vorks at Casino have risen by 10 per cent, vealer slaughter-ngs by 223 per cent and boned-out carcasses by 527 per cent.

PIG SECTION

Staff

This Section totalled 13 officers, but three more appoint-nents are to be made. There was one retirement and one ew appointment this year.

Extension (and Regulatory) Activities

Tabulated Summary.—The activities of this Section's officers n carrying out extension (and regulatory) duties are shown n the following table:—

	1961-62	1962-63	1963-64
arms visited	1,299	1,188	1,380
Meetings attended	63	38	52
Pig sales attended	242	165	169
Field days attended	35	21	14
Bacon factories and abattoirs visited	199	102	74
Experiment Farm visits	106	55	85
Shows attended	17	12	21
Lectures and demonstrations given	72	73	64
Press releases	....	....	41
Radio and television	66	56	83
Herd valuations made	79	26	....

Additionally, a constant stream of requests for advice on all phases of pig production was dealt with in office visits and by letter and telephone.

A comprehensive range of printed pamphlets on breeding, feeding, management and marketing was widely distributed; and daily and weekly newspapers were supplied with numerous press releases or comments.

The services were called upon by farmers' organisations, the Junior Farmer Club Movement, the Australian Pig Society, the Royal Agricultural Society of New South Wales, numerous country Agricultural Shows and the Rural and Commonwealth Development Banks.

The Departmental Herds

Large White, Berkshire, Tamworth and Landrace breeds were maintained in the Hawkesbury College, Wagga College, Wollongbar and Grafton herds. The first two Colleges' herds were used mainly for student instruction and ration purposes. The Wollongbar and Grafton herds were used for research. Some research was also conducted at Wagga College.

Pig sales totalled 855, for £10,813.

Pig Industry Trends

Lower Production.—Production of pig meats fell during 1963-64; a result of the high slaughterings in 1962-63, and the much reduced number of brood sows in production.

Baconers became very short in supply through Australia and New Zealand late in the year, and, with less pigs coming onto the market, prices paid to farmers have risen sharply. As is usual in the high price periods, enquiries regarding starting-up in pig raising have greatly increased. The year 1964-65 will show increases in number of holdings carrying pigs and number of pigs produced.

POULTRY SECTION

Staff

Fluctuations.—The establishment comprises 10 officers. Three positions are vacant. One retirement, two resignations, and two new appointments occurred this year.

Extension Activities

Tabulated Summary.—The following is a summary of poultry officers' activities this year.

Farms and hatcheries visited	1,469
Field days attended for demonstrations	14
Advisory visits to Government Institutions	40
Meetings attended	14
Press articles	55
Radio and television contributions	33
Lectures and symposia	9

Services of the officers were used by many farmer organisations, including Agricultural Bureau branches and Junior Farmer Clubs, also by the Royal Agricultural Society of New South Wales, country Agricultural Societies, various Poultry Clubs and the Commonwealth Development Bank.

Turkey Raisers School.—The 13th Annual Turkey Raisers' School was held at Wagga Agricultural College, with an attendance of fifty. The annual Poultry Farmers' Field Day was held at Hawkesbury Agricultural College, with an attendance of 800-1,000.

Poultry Industry Trends

Fewer Small Establishments.—The most significant trends in the industry were the continued decrease in number of small establishments (14 per cent fewer) and the increasing size and capacity of the larger ones.

Integration of Industry.—Another significant trend is the integration, horizontal and vertical, of the breeder/hatcheryman, grower, feed merchant and processor and the development of franchise hatcheries.

In the County of Cumberland, broiler production has almost completely converted from independent to the "contract" system. This is favouring the larger operators. They, because of their greater resources, are able to employ scientific staff and adopt the most advanced technology and equipment. This coupled with diminishing returns and margins is gradually forcing the small producer out of business.

Increased Broiler Production, Lower Returns.—The average return per lb. for broilers fell 3d., from 2s. 6d. to 2s. 3d. per lb., whilst production for the year increased from roundly 14 to 16 million broilers.

Increased Layer Stock, Poorer Market.—Laying stock maintained on egg producing farms increased by 19.7 per cent compared with the previous year, with corresponding increase in egg production. Because of loss of export markets, and the over-production for local requirements, the increased production is causing egg marketing authorities considerable concern.

APICULTURE SECTION

Staff

Numerical Strength.—The Section comprised six officers at 30-6-64, including one additional appointment being made this year.

Extension Work

Summary.—The activities included use of group methods and mass media as well as personal contact with beekeepers. An increased volume of articles was prepared for publication in *The Agricultural Gazette of N.S.W.*, Departmental leaflets and bee keeping journals.

A vacational beekeepers' school was held at Hawkesbury Agricultural College, and three beekeepers' schools were held at country centres. Also, several field days were held for beekeepers.

Officers of the section judged at the Sydney Royal Show and at a number of country Shows.

Bee Industry Trends

Record Honey Prices.—World shortage of honey and a consequent heavy demand by overseas countries resulted in record prices to producers. However this advantage was partly offset by lower production due to unfavourable seasonal conditions over a large part of the year.

Artificial Insemination.—To assist apiarists some hundreds of Queen bees were made available from Hawkesbury Agricultural College. These were specially developed from selected lines, maintained by using artificial insemination.

Bee Diseases

Foul Broods.—There was little change in incidence of American foul brood. Outbreaks were widespread. Prompt action by Departmental officers, with the co-operation of beekeepers, controlled most outbreaks in the early stages. A large number of hives became involved in only one outbreak.

One outbreak of European foul brood was recorded. This was in an apiary where American foul brood was also present.

Nosema disease was generally widespread.

Health of Imported Bees.—Many Queen bees were introduced by the industry, from a wide range of overseas countries. Particular attention was paid to their health by the Department. Destruction of one consignment from the U.S.S.R. was necessary because it carried the parasite *Braula coeca*. This parasite was already present in Tasmania, but has not been recorded in other parts of Australia.

Regulatory and Allied Services

DISEASE INCIDENCE AND ACTIONS

Anthrax

Thirty outbreaks were recorded. All were in the recognised anthrax belt. In one particularly heavy outbreak 500 sheep died out of some 5,000 before the mortality was brought under control. On this property the disease led to the death of a station hand who had removed pelts from sheep killed by the disease. Medical advice was not sought by him until an advanced stage.

Affected properties were placed in quarantine and all in-contact stock vaccinated. A summary of outbreaks is set out in the following table:—

Administrative District	Out-breaks	Stock Quarantined			Deaths		
		Cattle	Sheep	Pigs	Cattle	Sheep	Pigs
Central West	1	13	2,383	165	..	..	5
North West	1	1,500	....	..	20	..	..
South West	18	1,279	25,350	126	25	397	8
West	4	53	2,618	281	..	232	3
Far West	6	298	13,550	..	1	666	..
Totals	30	3,143	41,901	372	46	1,295	16

To reduce the risk for travelling stock, public routes and reserves on which deaths from anthrax had taken place in the past 5 years were quarantined for the summer. Nineteen routes and reserves were so quarantined. Only stock vaccinated against anthrax or conveyed by motor vehicles were permitted use of them.

To encourage more widespread preventative inoculation the number of licensed persons to inoculate against Anthrax was increased; 72 licences were issued.

Brucellosis (Pigs)

No outbreak was recorded. Under the voluntary Brucellosis-free Herd Scheme, breeding stock in 15 herds were submitted to the serum agglutination test. In these herds 291 pigs were tested; all negative.

Cattle Tick (Boophilus microplus) in North West

By illegal introduction of cattle from Queensland a tick-free area in the north west became infested. A quarantine area embracing 12 properties was declared. Environment in the area would not favour permanent establishment of the ticks, but proliferation could continue for a period. The parasite could then have spread to favourable regions. Included within the quarantine area were stock routes the infested cattle had been on.

Tick eradication from the area is being undertaken by leaving affected land unstocked for 16 months or, if stocked, requiring the cattle, sheep and horses to be treated fortnightly for 16 months. Stock using the affected routes have to be treated, and 3 treatments are given to stock about to leave the area.

Cattle tick is enzootic on the far north coast. There, control is exercised by the Board of Tick Control in conjunction with the Department. This regulatory work is subject of a later section of this Report (p. 68).

Footrot (Sheep)

This condition was widespread in the spring in south western districts, and sporadic in other areas. Affected properties (except in Armidale Quarantine Area) are not quarantined, but movement of infected sheep is illegal.

The Armidale Quarantine Area, containing some 2,800,000 sheep, was gazetted in 1960. It was intended to serve as a pilot area, to assess practicability of footrot eradication. To prevent the spread of infection in this area was desired also, because of low incidence there but the development of conducive conditions through rapid extension of pasture improvement.

The year favoured spread in this area. Wet conditions prevailed in the late spring and early summer. Pasture, particularly white clover, made prolific growth. Footrot outbreaks were considerably more than in any year since advent of the area. At the end of the 12 months affected properties were almost three times as numerous as at the beginning. Of a total of 11 properties affected at the commencement of the 12 months and 40 more outbreaks subsequently diagnosed, the disease is now considered eradicated from 22, leaving 29 affected. From only three holdings was the disease eliminated by treatment alone. From ten, eradication was achieved by treatment and the disposal of obstinate cases for slaughter. In nine cases all infected and in-contact sheep were disposed of.

Some of the outbreaks were particularly severe. Up to 80 per cent of sheep in some mobs showed symptoms. Militating against successful eradication in the area is the absence of a regular dry summer. Many pastures were lush for a full year. Most of the outbreaks were in the high rainfall, eastern part where most pasture improvement has taken place.

Johne's Disease

Three outbreaks were reported; while one previously affected property was released from quarantine. In each outbreak only a single animal was found affected, but one of the properties had a previous history of several deaths after suspicious symptoms. One of the outbreaks, which concerned a property where the disease had previously existed, was diagnosed through routine examination of intestinal material from cull cattle consigned for slaughter.

Many inspections for this disease were made on properties previously released from quarantine; also properties to which cattle had been sold by them after that release.

During the year a new policy of control was introduced. The period of one year's quarantine followed by five years of surveillance inspections was replaced with three years quarantine and no subsequent surveillance. After the first year's quarantine the sale of cattle is allowed under permit.

Parasites External (Sheep)

Notification of lice or ked in sheep by the occupiers of property is obligatory under the Stock Diseases Act. Properties containing infested sheep are quarantined until dipping has been undertaken and the flocks are clean.

Inspections at saleyards revealed many infested consignments. These were returned to the properties of origin. A policy of notifying adjoining owners, when a property was quarantined, was adopted. Following is a tabulated summary of the infestations detected:—

Administrative District	Lice Infestation		Ked Infestation		Ked and Lice	
	Holdings	Sheep	Holdings	Sheep	Holdings	Sheep
Central	48	87,018	2	771	1	1,300
Central West	183	104,906	20	21,965	7	4,487
Cumberland	15	2,301	..	..	..	..
Far West	298	315,378	..	..	..	..
North	120	123,066	18	14,096	4	2,485
North East	..	..	..	..	..	..
North West	134	254,474	..	..	..	..
South	106	67,210	..	..	..	..
South East..........	50	47,371	33	50,219	7	2,965
South West	197	149,477	..	..	..	..
West	52	67,272	..	..	1	1,300
Total	1,203	1,218,473	73	87,051	20	12,537

Pleuropneumonia Contagiosa (*Cattle*)

No outbreak occurred. Queensland cattle entering N.S.W. ere kept under surveillance, and restrictions were maintained entry of cattle into the two protected areas. In a consignent of cattle being tested for entry into another State eight ad reacted to the complement fixation test. However on test the reactors were negative. It is believed they were n-specific.

Pullorum Disease (*Poultry*)

Flock testing was done under both the voluntary Accredited ock Scheme and under Stock Diseases Act regulations reiring annual testing of flocks from which chickens under weeks of age, or hatching eggs, are sold. The accompanying bulation shows the details of testing undertaken:—

Scheme	Flocks	Birds	Reactors	Reactor Percentage
credited Flocks	71	399,153	398	0·09
mpulsory Testing	121	283,411	2,283	0·8
Totals	192	682,564	2,681	0·39

The 0.39 per cent reactors detected in all testing represents reduction from the 0.53 per cent in the previous year. The umber of flocks in the Accredited Flock Scheme was less an in the previous years. The number of flocks tested nder the Regulations increased.

A number of Pullorum outbreaks were investigated. Source infection was found to be flocks where infection level vealed by testing had been below 2 per cent. Where fection incidence is less than this figure the Regulations do ot require a retesting. Consideration is being given to mending the Regulations to provide more strict requirements this regard.

At the end of the 12 months the conditions governing the ccredited Flock Scheme were amended to provide for separate ccreditation of flocks and hatcheries. Classes of accreditaon for flocks in which up to 2 per cent reactors were etected have been eliminated. The amended scheme does not rovide for listing of flocks in which more than 0.5 per cent eactors are detected.

Trichomoniasis (*Cattle*)

Quarantine restrictions were placed on two properties where attle were found infected. Restrictions were removed from even properties previously quarantined. At the end of the 2 months, in addition to the two properties where positive diagnosis were newly made, four holdings remained under uarantine.

Circumstantial evidence suggested that the source of infecion for two herds found affected at the end of the previous year was a particular bull at the Aberdeen Artificial Stock Breeding Centre. This bull was then subjected to a test mating and proved positive. The remaining bulls at the Stock Breeding Centre were immediately test-mated. This detected the disease in another bull.

Semen produced by one of the two infected bulls had been used both in the chilled and deep frozen states. In the other case all semen had been equilibrated and deep frozen. Both affected bulls were destroyed. Subsequently Trichomoniasis, probably introduced by way of chilled semen from the infected bull at the Centre, was later diagnosed in another herd.

Tuberculosis (*Cattle*)

Area Eradication.—A programme of tuberculosis eradication on an area basis was initiated in 1960 when an area with some 60,000 cattle was gazetted as a Quarantine Area. In this the testing of all cattle was compulsory. Additional Areas have been gazetted since then. At the start of the current twelve months, 32 such Areas, containing some 608,000 cattle, existed. This year an additional 17 Areas, with about 357,000 cattle, were brought into being. Thus, at 30th June. 1964, there were 49 eradication Areas, containing some 965,000 cattle.

All Areas are coastal. They embrace districts where dairying is the main cattle industry. Beef cattle where present must undergo the same testing as the dairy stock. The overall percentage of dairy cattle in the Areas is about 75 per cent.

Official policy for the eradication Areas requires annual testing until the Area incidence has fallen to 0.5 per cent. Then testing is biennial. Annual and biennial testing is undertaken by approved practising veterinarians, at the expense of stockowners. However, retesting of infected herds is done by official veterinary personnel, without charge. Reactors are slaughtered under supervision at abattoirs, with compensation to the owners.

Testing was done this year in 46 Areas, carrying an estimated 916,000 cattle. Particulars of the different classes of testing are set out in the accompanying table. There is some overlapping, in that this year certain districts underwent some first and second year testing and some underwent second and third year testing:—

Test	Areas	Cattle Tested	Reactors	Reactor Percent	NVL	Percent of Reactors NVL
1st Year	36	345,977	2,257	0·66	483	21·4
2nd Year	20	107,911	276	0·26	50	18·1
3rd Year	7	101,532	248	0·24	49	19·8
Retests	36	57,063	600	1·05	89	14·8
Introductions	45	23,026	73	0·32	17	23·3
Totals	46	635,509	3,454	0·54	688	19·9

No Visible Lesion (NVL) reactors totalled 19.9 per cent of all reactors and 0.11 per cent of all of the tuberculin tests undertaken. The incidence of NVL reactors varied considerably between different Areas. In one Area 34 of 48 reactors detected, out of 3,678 cattle tested, were NVL. In another Area there were 62 NVL cases, out of 109 reactors detected from 12,274 head of cattle.

Tissue from a number of NVL cases was bacteriologically examined in an attempt to find non-pathogenic sensitising organisms. No such organisms were recovered.

The following table sets out the various levels of infection detected in different Areas in first, second and third year testing. In no Area has later than third year testing yet been done. It will be noted that the proportion of Areas showing less than 0.1 per cent infection was significantly less among those undergoing third year testing than in those in their second year of testing. However, those Areas now undergoing third year testing represented the earliest declared Areas which were specially selected in localities known to be heavily infected:—

[Stage of Testing	Areas Tested	Areas Reactors < 0·1%	Areas Reactors 0·1—0·5%	Areas Reactors 0·5—1·5%	Areas Reactors > 1·5%
1st Year	36	3	15	14	4
2nd	20	7	8	5	..
3rd	7	1	4	2	..

Tubercle-free Herd Scheme.—This is a voluntary scheme of accreditation. It has been maintained for many years. It is mostly availed of by the owners of stud herds. A total of 135 herds were listed as tubercle-free; 97 of these contain 13,364 cattle under test during the year. There were six reactors.

Tubercle-free Milk Scheme.—This scheme is designed to ensure that non-pasteurised milk being sold for human consumption is produced by tested herds. The administrating authority for the larger cities is the New South Wales Milk Board, and for smaller cities and towns the municipal and shire councils. However, it is the responsibility of the Department of Agriculture to certify freedom from tuberculosis. Cattle tested under this scheme number 17,081, and 61 were positive.

Miscellaneous Testing.—Testing under this heading included the compulsory testing of known infected herds outside eradication Areas; and voluntary testing for cattle export, sale, exhibition or diagnostic purposes. In this category 64,149 head of cattles were tested; 896 were positive.

Incidence in Beef Herds.—Incidence of tuberculosis is considerably lower in beef than in dairy herds but some heavily infected individual beef herds have been counted. Eradication has proved significantly more difficult than in dairy herds. The factors are inability to obtain complete musters for testing, movements of stock between adjoining holdings, and greater difficulty in interpreting reactions in the caudal fold of beef animals.

The possibility of spread of infection by wild pigs is being considered.

One beef herd which 18 months previously had yielded 269 reactors out of 939, received its seventh test towards the end of this 12 months. There were 11 reactors. However, after the last test two negative reactors revealed lesions of tuberculosis when consigned for slaughter.

Tuberculosis (Poultry)

Forty outbreaks were diagnosed, necessitating quarantine of the properties. Of the outbreaks, 33 were in a southern region where tuberculosis has been enzootic in poultry for a considerable period.

Control is by consignment of affected and in-contact birds for slaughter when they reach marketable age, and two years spelling of ground on which they have been running. The tuberculin test has been found unreliable.

One of the flocks in which disease was diagnosed comprised 25,000 ducks under intensive conditions. The infection level was not high.

On a property in the enzootic area where poultry had been found infected, tuberculosis lesions confirmed by detection of the causal organisms were seen in 12 wild sparrows that had been shot. Wild birds are suspected disseminators in that area.

Swine Fever

No outbreak was recorded. The last clinical case was in November, 1962. Submission of serum samples from blood obtained at abattoirs, to the gel diffusion and serum neutralisation tests, revealed some positive reactions. However, the properties of origin had not had any disease resembling swine fever. Significance of these reactions is obscure. The matter is being further studied.

In the main the regulations imposed when swine fever was first diagnosed were maintained. The North Coast Protected Area was abolished and the whole of New South Wales was proclaimed as a Quarantine Area for swine fever. This caused restrictions to be applied on additional parts of the north coast.

Boiling of food refuse fed to pigs is now compulsory throughout the State. The ban on sale of pigs in public saleyards for purposes other than immediate slaughter continued. However, return of pigs from such sales, to property of origin, is now permitted. Holding of public clearing-out sales and special sales of stud pigs is also allowed. Restrictions on pigmeat movement have been deleted.

ACTIONS UNDER SWINE COMPENSATION ACT

The livestock officers assisted in the preparation and examination of many claims, for pigs ordered for destruction and for carcasses condemned because of disease. No total herd was destroyed on account of swine fever. Thus, expenditure from the Swine Compensation Fund decreased considerably.

The position of the Fund at 30th June, 1964, was:

	£
Balance in Fund 1-7-1963	44,943
Receipts for 1963-64	60,878
	105,821
Expenditure 1963-64	12,716
	93,105
Less Advance from Treasury still owing	50,000
Credit Balance at 30th June, 1964	43,105

ACTIONS UNDER SWINE BRANDING ACT

Regulatory work under the Swine Branding Act, 1940, continued. Court proceedings were successfully undertaken in a number of instances.

An index of brands issued under the Act has been compiled, for distribution to officers carrying out duties under the Act. The index will enable rapid determination of origin of diseased pigs.

ACTIONS UNDER CATTLE COMPENSATION ACT

Compensation Claims

Claims and Payments.—11,156 claims were dealt with, involving 18,000 animals. Compensation payments amounted to £282,559. Compared with the previous 12 months figures there were 3,900 more claims, involving 2,096 more animals, and an increase of £50,759 in compensation payments.

Diseases Concerned.—Diseases for which compensation was paid, were as follow: tuberculosis, 6,786; cancer, 6,549; actinomycosis, 3,129; actinobacillosis, 1,474; pleuropneumonia contagiosa, 2; trichomoniasis, 57; and Johne's Disease, 3; total, 18,000.

Claims Disallowed.—Claims for which compensation was disallowed comprised 170 for delayed notification of disease by owners, 13 for failure of owners to notify disease, 11 for failure to pay compensation levy, and 7 for delayed application for compensation; total 201.

Claims Reduced.—Payment was reduced in the case of 81 claims, where application for compensation was not made within 60 days of slaughter.

Condition of Compensation Fund.—Administrative costs were lower but there was also substantial decrease in levy payments. With number of claims greater there was virtually no increase in the credit balance of the fund. Balance of the fund, for each of the last five years, has been as follow:—

	£	s.	d.
Balance as at 30th June, 1960 ..	237,873	2	8
Balance as at 30th June, 1961 ..	376,209	9	8
Balance as at 30th June, 1962 ..	599,767	12	7
Balance as at 30th June, 1963 ..	726,289	9	7
Balance as at 30th June, 1964 ..	727,912	13	2

ACTIONS UNDER STOCK FOODS AND MEDICINES ACT

Stock Foods Registrations.—This year 1,763 applications for registration of stock foods were received and approved.

Stock Medicines Registrations.—Applications for the registration of stock medicines totalled 1,769; of these, 1,581 medicines were registered. The 1,581 comprised re-registration of 1,228 medicines and 353 medicines registered for the first time. Nine applications for registration were withdrawn by the manufacturers. The Stock Medicines Board deferred eight applications until the next registration year. Applications received towards the end of the year but not yet dealt with totalled 171.

SERVICES UNDER COMMONWEALTH QUARANTINE ACT

The Division of Animal Industry continued to administer the animal provisions of the Quarantine Act, 1908-61, for the Commonwealth Government. The volume of work trended upwards, through greatly increased air traffic to the Kingsford Smith Airport, Sydney.

Quarantine staff comprising two veterinary officers and five Port inspectors dealt with all quarantine work at Sydney and Port Kembla; the Newcastle District veterinary officer did the quarantine work there; other field officers as needed did the inspections relating to export of stock.

Imports

Animals.—Pig importations from New Zealand were permitted this year, after prohibition for a number of years. Only 15 pigs were so imported. An increase is expected.

Day-old chickens were imported from New Zealand for the first time; 17,125 of them. Although not prohibited, chicken importations were not feasible until late last year permission was granted for their introduction by air.

The total of horses and cats arriving from the United Kingdom and New Zealand increased slightly. Fewer dogs were brought in from those countries.

Introduction of cattle, sheep, pigs and goats to Australia remained totally prohibited.

The total of zoological animals imported was twice that of the previous year. In accordance with official policy, these were allowed to enter only registered zoological gardens and circuses. There they were maintained under surveillance.

Smuggling of birds from overseas ships again received attention. Several suspected cases were investigated in cooperation with Customs and Excise officers.

Animal Products.—Imports of furred skins, frozen meat d wool were lower. Imports of fishmeal, tinned meats, athers, hair, hides, skins and cheese increased; substantially the case of the latter three.

With prohibition on importation of raw cattle hides and ins except from Canada, New Zealand, Ireland, United ingdom, U.S.A. and certain Pacific Islands, the source of raw aterial for some tanners was eliminated. To counteract this, me wet chrome skins were imported. Investigation revealed at the skins had been fully chrome-tanned, but not finished. ne consignments were permitted to land for the finishing eatment, under quarantine control as partially manufactured oducts.

Passengers' Luggage.—Co-operation continued between the nimal Quarantine officers and Customs officers in searching r illegal goods in the baggage of passengers arriving by a or air. Quantities of prohibited imports such as salami, her meat products, home-made cheese, and other foods were ized—at least as much as in previous years.

Illegal importation of food and other material of animal igin in this way is one of the most serious problems facing e Quarantine Service. Much of this material comes from untries where animal diseases not present in Australia do ist.

This work has assumed greatly increased importance with e continued increase in the number of passenger arrivals nd especially the arrivals by air. In 1963-64 there were 48,893 passenger arrivals; 54,130 by ship and 194,763 by ircraft.

The extent of passenger arrivals necessitated provision of continuous inspection service at Kingsford Smith Airport rom 6 a.m. to 10 p.m., seven days a week.

Parcels Post.—The volume of goods, subject to quarantine ontrol, arriving from overseas by parcels post continued to e considerable. Centres of introduction were Sydney, Newastle and Port Kembla. Many items of exotic food of animal rigin were seized.

Trade Samples.—A number of trade samples of materials ormally prohibited were imported, under strict quarantine ontrol, for analytical examination. This action was taken o enable local manufacturers to study and keep abreast of verseas developments.

Trade Fair Display Materials.—Close liaison was mainained with the Department of Customs and Excise when oods were imported for display at the Sydney Trade Fair, to nsure that no prohibited material was landed. Several conignments of animal origin foodstuffs not conforming fully o the quarantine requirements were detained in bond pendng re-exportation.

Animal Exports

Supervision over export of animals continued; involving inpection of stock, and treatment.

Exports of day-old chickens to Malaysia and various Pacific slands significantly increased. To help the exporters, arrangenents were made for the veterinary inspection to be done at he Sydney Airport in lieu of in the Department.

Other bird exports sharply decreased, owing to the imposiion (under Customs Legislation) of an embargo on export of native fauna. Previously, there were many export consignments of native birds.

Of interest, although in 1962-63 only 117 sheep were exported, a total of 74,591 left Australia in 1963-64. This great increase was due to export of 69,338 crossbred sheep, primarily ewes, to Mexico; 2,515 Corriedales to Columbia, and 2,452 Corriedales to Ecuador.

Treatment of Livestock Ships Arriving

All ships constructed primarily for carriage of livestock, arriving from overseas, were examined; and treated with insecticide. Because of the number of sheep exported, many livestock vessels came to Sydney. Each was clean and did not require insecticidal treatment. On one vessel, which plied between Australia and Mexico, dead specimens of the secondary screw fly *Collitroga macellaria* were found; a parasite not yet found in Australia.

Ships' Pets

Strict supervision of ships' pets on overseas vessels continued. These are held under bond. One pet, an Indonesian mongoose, escaped from a boat berthed at Newcastle. An intensive hunt was organised, with police and Customs officers assisting. The animal was captured. The Shipmaster's Bond was estreated.

Liaison with Other Services

Reference has been made to co-operation between Quarantine officers and Customs officials. A senior officer of the Animal Quarantine Service addressed Customs officers at a number of Customs Trainee Schools, explaining the significance of the quarantine service and laying the basis of co-operation. Officers of the Papua-New Guinea Administration also were addressed.

Liaison was maintained also with the General and Plant Quarantine Services. Imported goods of dual interest were referred to the other Service before release. Saddle cloths within a consignment of 100 second hand saddles imported from Sweden were found during disinfection to be infested with small seeds and were held until clearance was given by the Plant Quarantine Service.

MEAT INSPECTION SERVICES

Three Authorities.—In New South Wales meat inspection is under the jurisdiction of three separate authorities. Inspections at abattoirs which supply meat to the Sydney metropolitan area, are conducted by inspectors of the New South Wales Department of Agriculture. The Commonwealth Department of Primary Industry is responsible for export carcasses. Inspections at slaughtering establishments where neither State nor Commonwealth Meat Inspectors operate are the responsibility of municipal and shire councils.

Improvements.—Highlights of the past 12 months have been overall improvement in the hygiene of meat handling at all meat works, improved facilities for meat inspection, and closer co-operation between meat inspectors of the Commonwealth Department of Primary Industry and the State Department of Agriculture. This has all been brought about and accelerated by the demands of the United States Department of Agriculture with regard to standards in abattoirs and other premises handling meat for export to north America.

There has been an agreement between the Commonwealth and State Departments involved, to organise all meat inspection on a joint basis at all abattoirs licenced to kill for export. Uniform standards of inspection will be and are being carried out at all export works, under the control of a veterinary officer in each—appointed by the Department of Primary Industry. The State Inspectors are assisting in maintaining standards of hygiene as required by the U.S. authorities at all premises killing or processing meat for export to the United States of America and Canada.

While high standards of hygiene are now becoming mandatory for the export trade it is unlikely that the public generally will be prepared to accept anything less on the home market.

Staff.—Contrary to expectations a reduction in number of meat inspectors employed in New South Wales by either the State or the Commonwealth has not been realised. This is due to the greater number of meat inspectors required to effect the more exacting standards demanded by the Americans.

There was an increase in the establishment of State staff during the year. Veterinary officers increased from two to three and meat inspectors from 165 to 184.

New Abattoir at Moree.—Gwydir Valley County Council Abattoir, Moree, commenced slaughtering operations and will require five meat inspectors to carry out routine inspection in conjunction with the Commonwealth Service.

Carcasses Inspected by State Service.—The volume of inspections is indicated by the following tabulation:—

	Cattle	Calves	Pigs	Sheep
State Abattoir	195,071	107,973	124,278	2,557,248
County of Cumberland (excluding State Abattoir)	48,936	27,695	18,919	1,114,818
Country Abattoirs	507,618	263,015	281,265	2,971,792
Totals in N.S.W.	751,625	398,683	424,462	6,643,850

Carcass Condemnations (Total).—The following tabulation shows the details of "total carcass" condemnations:—

Condition	Cattle		Calves		Pigs		Sheep	
		Per Cent		Per Cent		Per Cent		Per Cent
Actino	5	·0006	..	..	..	..	..	..
Arthritis (multiple)	60	·0079	66	·016	1,236	·291	3,881	·058
C.L.A.	..	..	..	..	..	..	2,668	·040
Cysticercus Ovis	..	..	..	..	..	..	168	·002
Emaciation	653	·0868	13	·003	55	·0129	14,634	·220
Sarcosporidiosis	2	·0002	..	..	..	..	424	·006
Septic Conditions	286	·038	75	·018	946	·222	628	·009
Tuberculosis	1,546	·205	37	·009	268	·063	..	..
Other Conditions	1,246	·165	708	·177	405	·095	4,827	·072
Totals	3,798	·505	899	·225	2,910	·685	27,230	·409

Partial Condemnations.—The next tabulation shows the details of "partial carcass" condemnations:—

Condition	Cattle		Calves		Pigs		Sheep	
		Per Cent		Per Cent		Per Cent		Per Cent
Actino	13,383	1·780	10	·002	..	..	..	..
Arthritis	2,202	·293	54	·013	2,974	·700	6,889	·103
C.L.A.	..	..	..	..	..	..	14,877	·223
Cysticercus Ovis	..	..	..	..	..	..	..	..
Emaciation	..	..	..	..	..	..	..	..
Sarcosporidiosis	2	·0002	..	..	..	..	2	·00003
Septic Conditions	150	·0199	15	·003	294	·069	320	·004
Tuberculosis	1,993	·265	3	·0007	708	·166	..	..
Other Conditions	6,141	·817	46	·011	6,160	1·451	6,323	·095
Totals	23,871	3·175	128	·032	10,136	2·387	28,411	·427

Beef Liver Conditions.—Periodic surveys of beef livers condemned at Homebush Bay showed percentages condemned for various diseased conditions to be as follow: liver fluke infestation, 22.6 per cent; hydatid disease, 1.5 per cent; telangiectasis, 1.1 per cent; abscesses, 1.5 per cent; multiple adhesions, 1.6 per cent; melanosis, less than 0.01 per cent; and tuberculosis, less than 0.01 per cent.

Meat Re-inspected on Introduction from other States and New Zealand.—The re-inspections comprised: beef carcasses, 47,141, and piece meat 4.896,667 lb.; veal carcasses, 114,106, and piece meat 182,573 lb.; pork carcasses, 93,487, and piece meat 6,634,966 lb.; mutton carcasses, 51,176, and piece meat 400,432 lb.; bacon sides, 534, and piece meat 1,934,686 lb.; sundries, 968,579 lb.

Ante-mortem Inspections.—All cattle were inspected prior to slaughter at the Sydney Metropolitan Abattoirs. In addition, the inspection of cattle and pigs at the saleyards in the precincts of these abattoirs is the responsibility of the meat inspection service. All sales at these yards were attended for the inspections.

Meat Markets, Depots, Shops.—Full time inspection was provided at the Wholesale Meat Markets, Sydney Metropolitan Abattoirs. Part time inspections were regularly made at various private meat depots and markets. Visits totalling 1,220 were made to shops retailing meat, for policing of the Meat Industry Act.

Knackeries.—At knackeries 9,034 horses and 12 cattle were inspected.

BOARD OF TICK CONTROL (CATTLE TICK)

The Board of Tick Control has the responsibility of controlling the cattle tick (*Boophilus microplus*) on the far north coast of N.S.W. where it is enzootic.

Staff Reductions.—There was gradual reduction in the Board's staff this year, from 507 in the field staff at the start to 445 at the end of the 12 months. There were also 269 changes of staff locations, mostly arising from the strategic dipping policies.

Eradication Measures

North-Eastern Maclean Area.—A programme of inspections at twenty-one days intervals was continued until 30th April, 1964. During this period 18,830 stock were examined. No evidence of cattle tick was found. A surveillance policy will now be maintained until 31st December, 1964.

Currawinya Area.—An eradication programme was continued. The Area was kept free of stock until 31st May, 1964. It is now being restocked and a programme of examinations will be carried out during the coming year.

Rivertree Area.—A policy of examinations at twenty-one day intervals was commenced on 14th October, 1963, and continued until 31st May, 1964. During the 5th round of examinations a single semi-engorged *Boophilus* sp. female tick was found. The stock on this holding were treated. No further infestation was found. The Area reverted to a policy of control on 12th June, 1964. Restrictions on the movement of stock into the Area were lifted. Gates were removed from internal quarantine boundaries.

Copmanhurst Area.—A policy of examinations at twenty-one day intervals was commenced on 14th October, 1963, and continued until 31st May, 1964. During examinations in February and April, four infestations were detected on properties in widely separated localities. Stock on the infected holdings were subjected to routine treatment. Restrictions were imposed on the movement of stock from these holdings and adjoining properties. The Area is being retained in quarantine.

Tick Fever

The position is very satisfactory. No outbreak occurred. Normal control measures were maintained on the two properties at Piggabeen and Doubtful Creek previously involved in outbreaks. All cattle over the age of four months were bled and the sera were submitted to the C.S.I.R.O. for the complement fixation test, to determine whether any carriers remained in the herds. All results were negative. The holdings were released from quarantine.

Testing of cattle for presence of carriers, by means of the complement fixation test, is a major advance in tick fever control in New South Wales.

Control Policies

The 1963-64 control policies were similar to those of 1962-63; a strategic dipping campaign whereby all stock were treated at twenty-one day intervals for a short period of the year, and a limited number of treatments for infested stock.

Control Work East of the Richmond Range.—Within the Richmond, Tweed and Kyogle Quarantine Areas a strategic dipping campaign was carried out from 9th September to 20th December. Stock on every holding were given five treatments at twenty-one day intervals. Some concessions were allowed for calves under three months, due to toxicity problems from use of organic phosphates.

Staff maintained the dips and in nearly all cases super-sed the treatment. Shortage of staff prevented full super-sion. On completion of the dipping programme some staff ere transferred west of the Range. The remainder for the xt five months examined stock on holdings, to determine e number of and degree of infestations.

Over 90 per cent of stock were treated during the dipping eriod. The results, in the accompanying tabluation, show n increase in the number of infestations detected:—

Area	Number of Infestations Detected			
	1960-61	1961-62	1962-63	1963–64
ngalow	30	14	21	19
vogle	11	3	19	60
smore	31	8	19	24
mbin	26	11	13	13
veed	28	4	7	12
sino	33	20	40	67
Total	159	60	119	195

he number of inspections was considerably greater than 1962-63; therefore the number of infestations can be ccepted as more reliable indication of the position. The festations detected were classified as 66 heavy, 21 medium nd 108 light; compared with 38 heavy, 4 medium and 77 ght infestations in 1962-63.

Control Work West of the Richmond Range.—The policy f strategic dipping was undertaken in Woodenbong, Bonalbo nd Tabulam areas. It comprised treatments at twenty-one ay intervals, from 13th January to 3rd April. The policy lso required that all stock be examined prior to movement n these areas. Although the year favoured tick life, the umber of detected infestations was again very limited, as hown in the following tabulation:—

Area	Number of Infestations Detected			
	1960–61	1961–62	1962–63	1963–64
Voodenbong ..	4	2	..	..
onalbo	1	..	..	1
abulam	1	..	2	1
ivertree	2	2	..	1
opmanhurst ..	..	..	..	4
	8	4	2	7

Abattoirs Examination of Stock.—The policy of retaining ssistant inspectors at Grafton, Macksville and Tenterfield Abattoirs, outside the Tick Quarantine Areas, to examine tock slaughtered, was continued. At Tenterfield the assistant nspector also supervised unloading of cattle moving from Vallangarra by train and dipping of all ex-Queensland calves rior to slaughter.

No tick was found at Tenterfield, but large numbers were collected at Grafton and Macksville. All were identified ither as *Haemaphysalis* or *Ixodes* species. No cattle tick vas detected.

In addition, assistant inspectors were stationed at Casino nd Byron Bay Abattoirs, within the Tick Quarantine Areas, rimarily to examine all calf carcasses after skinning and to emove any ticks found on the carcasses. In most cases icks found were *Haemaphysalis* species.

Examinations in Clean Country.—Inspections were made in ections of country previously released from quarantine. No attle ticks were found.

Claims for Compensation

Compensation claims were paid for the loss of 204 head of stock, by death or injury as a result of dipping. Payments made totalled £3,403.

QUEENSLAND BORDER CONTROL

Responsibilities.—An inspection staff is maintained along the adjoining Queensland border. This is necessitated by existence of restrictions on introduction of stock, because cattle tick is enzootic in a large section of Queensland.

The Border Inspection staff are responsible for the whole of the Border with the exception of the extreme eastern section. This latter section covers the boundary between Queensland and that part of New South Wales where the cattle tick is enzootic. Responsibility for control of this section of the Border is vested in the Board of Tick Control (see p. 68).

Introduction of cattle from Queensland into the enzootic cattle tick area of New South Wales is prohibited because of possible introduction of tick fever.

Staff.—Border staff at the end of the year numbered 72; three more than in the previous year. The border is divided into three administrative sections, each under an Inspector-in-Charge.

Stock Movements.—Stock movements into New South Wales showed an overall increase, compared with the previous 12 months. The following tabulation shows the details:—

Administrative Section	Cattle	Other Stock
Stanthorpe	147,319	55,464
Goondiwindi	112,185	374,415
Mungindi	56,847	321,409
Totals	316,351	751,388

Mungindi Quarantine Restrictions.—Following the detection of cattle tick in cattle introduced from Queensland to the Mungindi area of New South Wales, the Mungindi crossing was closed to all stock on the hoof for the greater part of the year. This necessitated diversion of large numbers of stock which normally would have crossed at this point.

Fencing.—In the Stanthorpe Section where the border is fenced, two miles of replacement fencing were erected. Considerable difficulty was experienced as the area involved is in steep, rugged terrain. It was necessary to construct an access road. Cost of this work was £2,400. Minor repairs were done from time to time by the Border staff to other portions of the fence.

DIVISION OF DAIRYING

General

Activities Summary.—Activities comprised: administration of the Dairy Industry and Dairies Supervision Acts and Regulations; the Herd Production Improvement Scheme; extension and research related to efficiency in the dairying industry; and maintenance of dairy products' standards.

The Production Year.—Production of milk and of manufactured products were in general comparable with those of the previous year, as indicated by the following statistics:—

	1962-63	1963-64
Milk	325,869,000 gal.	328,411,000 gal.
Butter	80,428,739 lb.	80,295,249 lb.
Cheese	11,881,344 lb.	11,526,335 lb.

New Zealand Visit by Deputy Chief.—Deputy Chief Mr. J. D. L. McGibbon represented this Department at the International Dairy Federation Conference in New Zealand from 3rd to 9th November, where representatives from all dairying countries in the world attended. Members of the Conference who subsequently spent a few days in Australia toured the Hunter Valley and visited various dairy produce plants in Sydney, arranged by Division of Dairying.

COMMONWEALTH DAIRY INDUSTRY EXTENSION GRANT EFFECTS

Promotion of improved farm practises in the dairying industry continued, with the aid of funds from the Commonwealth Dairy Industry Extension Services Grant. The funds were expended mainly, so far as this Division was concerned, on group herd recording, sire survey, farm demonstrations of technical nature, milking machine efficiency surveys, and an air-flow meter testing station at Hawkesbury Agricultural College. All of these have created and held considerable interest amongst dairy farmers.

HELP TO AUSTRALIAN DAIRY PRODUCE BOARD, TOWARDS SOUTH EAST ASIAN MARKETS

Dairy Officer Mr. D. Gillies has been seconded to the Australian Dairy Produce Board for the period from November, 1963 to May, 1965, to assist establishment of re-combining milk plants in the South East Asian area. The plants will develop sale of Australian dairy products here. Dairy Officer Mr. A. K. Potts is at present on secondment but will return shortly.

LEGISLATION AMENDMENT

Dairies Supervision Act Regulations.—New Regulations effective from 1st January, 1964, provided for repeal and replacements of existing Regulations made under the above Act, and made special new provisions—prescribing standards of construction and maintenance for dairy premises and ancillary facilities.

The purpose of the Regulations was to allow Local Government Councils throughout the State to enforce a reasonable standard of dairy premises construction. This was at the request of Local Authorities, through Department of Local Government. However, through powers as Local Authority under the Dairies Supervision Act (Section 6) a Council may grant registration to dairy premises even though the premises may not fully comply with requirements specified in the Regulations.

Regulatory Services

DAIRY INDUSTRY ACT, 1915-62

Advisory Committee.—The Dairy Produce Factory Advisory Committee approved two applications for registration of premises as dairy produce factories and eight applications for registration of a dairy produce store.

Appeal Board.—The Appeal Board constituted under Section 2 to deal with appeals against decisions of Inspectors under the Act, did not have occasion to meet.

All factories registered under the Act were inspected through the year by officers of the Division and satisfactorily complied with suggestions for improvement and various remedial orders. Many alterations to plant and equipment and general factory outlay were made, amounting to thousands of pounds in expenditures.

Butter

Manufacture and Grading.—The butter grading staff regularly examined the butter and cheese manufactured by New South Wales factories and received at Sydney, Newcastle, Wollongong and Canberra for distribution and storage prior to sale on the local market. Samples from Wollongong and Canberra were sent to Sydney for grading. Officers regularly visited Newcastle. Butter manufactured at Casino Co-operative Dairy Society was examined there prior to cold storage locally.

Information from these gradings was in each case supplied to the factory managers and District dairy officers, to help overcome any quality faults or other manufacturing troubles noted at time of grading.

Considerable quantities of butter were imported into New South Wales from other States during the late autumn, the winter, and early spring to supplement local production. At the request of the selling agents the quality of this butter was checked by Departmental graders prior to distribution.

The services of grading officers were availed of as judges and stewards in the Dairy Produce Sections of the Royal Sydney Show, Newcastle Show, Lismore Show, Coff's Harbour Show, and for competitions held in conjunction with the New South Wales Division of the Australian Institute of Dairy Factory Managers and Secretaries.

Quantities Examined and Graded.—Boxes of butter from interstate and intrastate sources examined by State graders totalled 1,403,830; compared with 1,463,729 in the previous year; and 4,337 Grade Certificates were issued.

Moisture and Salt Analyses.—Analyses for moisture and salt content of butter manufactured at New South Wales factories were done. The results were forwarded to District dairy officers and factory managers. Samples were regularly taken and forwarded to Division of Science Services for biological examination. These results also were forwarded to District dairy officers and factory managers.

Special Investigations re Butter Defects.—Several special investigations in regard to butter quality defects were conducted at various factories. The Biology and the Chemistry Branches, Division of Science Services, co-operated with Division of Dairying where needed.

Retail Butter Surveys.—These were conducted in the Sydney metropolitan area and in country districts, to determine the quality of butter reaching the consumer. Consequent discussions with distributors and manufacturers took place, with a view to checking faults detected in the surveys.

Order of Merit (Butter) Competition.—This was again conducted. To qualify for an Order of Merit Certificate a dairy produce factory must market true to choicest brand at least 92 per cent choicest brand butter examined by butter graders of this Department and the Commonwealth Department of Primary Industry. Sixteen factories were awarded Merit Certificates, compared with 17 last year.

Percentage of Butter Marketed as "Choicest".—The percentage this year was 93.2 per cent compared with 94.2 per cent last year.

Cheese

Quality Survey.—Cheese quality was variable. A cheese quality survey is being conducted. In this a monthly check of manufacture is done by the District dairy officers and the resultant samplings are submitted to Division of Science Services for bacteriological and chemical analyses. There has been outstanding improvement in the last three months of the fiscal year. Factories have co-operated willingly and carried out suggested improvements in plant and manufacturing technique.

Voluntary Grading Scheme.—Voluntary grading of all cheese from participating factories continued. The data obtained have been very useful to the Department and the factories concerned.

Starters.—New installations of bulk starter units have been made at one of the larger factories.

Generally, starter technique improved this year but a number of fancy cheese makers in the metropolitan area need keener interest in this important phase of cheese manufacture. Specialist attention by head office personnel has been given to this need.

The problem of traces of antibiotics in milk received from farmers is under attention; the traces inhibit growth of certain organisms necessary in cheese-making.

Cheese Production Trends.—For the sixth successive year seasonal conditions favoured the cheese producing districts. Production has been on a par with the previous year's total of 5,300 tons. Further expansion in vat capacity is being considered by two south coast factories.

Interest in the manufacture of fancy cheese remained mainly in the metropolitan area. Some of the soft cheeses produced have short shelf life and must be made at a site as near to the market as possible. High cost of purchasing milk from the Milk Board production districts has accordingly limited production of these cheeses.

Larger milk distributing companies with the necessary market facilities have enlarged their manufacture of cottage cheese and yoghurt. This market is capable of rapid expansion.

Production of cheese processed into other foods has expanded considerably this year, especially on the north coast. Requests for information have been received from various food processors who wish to use cheese in blended food products. Greater outlet for cheese in this way can be expected.

Export of cheese from N.S.W. has been limited to ships' stores and a small quantity to the Pacific Islands. The factories with an export license have found it more profitable to trade on the local market. No export expansion is anticipated, since N.S.W. produces only half the cheese consumed in this State.

Margarine Manufacturing Licences

Following Ministerial approval, 1964-65 licences for manufacture of table margarine, cooking margarine and margarine for export have been issued to the seven firms concerned—for similar quantities to those previously licensed.

The licences for table margarine and cooking margarine were issued subject to certain additional conditions. These conditions have been designed to aid enforcement of table margarine quotas, by facilitating Dairy Industry Inspectors' access to production records required to be kept by the licensees.

Two successful prosecutions were undertaken, for late submission of monthly margarine manufacturing returns.

FACTORIES AND SHOPS ACT

Departmental officers are authorised as inspectors under this Act to supervise safety measures within the dairy industry. All necessary steps were taken to ensure conformity with the regulations. This work was done in conjunction with normal duties and did not necessitate special visits.

Extension Services

Dairy Science Schools and Competency Certificates.—Six Dairy Science Schools were held, in various parts of the State, or tuition and examination of 216 candidates for qualification nder the Act.

Examination—	Certificates Issued
Cheese making	6
Butter making	5
Milk Grading	64
Milk Testing	43
Cream Testing	28
Cream Grading	16

The Schools included milk grading as well as cream grading nd milk and cream testing, and became overcrowded because f including milk graders. It has been decided that future chools will revert to the earlier system, covering milk and ream testing and cream grading; milk grading examinations will be conducted separately.

Statistics of Farm Visits.—About 4,600 farms were visited by airy officers for general extension work. In addition, 126 isits were made in connection with Dairy Industry Extension Grant demonstrations and 1,651 visits were made for herd mprovement instruction. Dairy officers travelled by car 74,388 miles in the course of the year's work.

Statistics of Group and Mass Activities.—Dairy officers ttended for extension purposes 180 field days, 43 film evenings, 44 meetings of Agricultural Bureau branches and of branches f other primary producer organisations, and 35 Agricultural hows. The Shows include the Royal Agricultural Society how, where officers functioned as judges and stewards in the Dairy Cattle and Dairy Produce Sections.

Some 150 radio talks were given.

Herd Production Improvement Work

Herd Recording.—The prime purpose of Herd Recording is o enable members of Units to obtain reliable information whereon to base a programme of herd improvement and increase production efficiency.

Late in 1963-64 a major expansion of the Scheme was approved but too late for full implementation in this fiscal year. However, 10 additional Herd Recorders and two Relief Recorders commenced duty during May and June. Full impact of this additional work force will be apparent in 1964-65.

The total of cows under official test was 11,300 (10,630 in 1962-63), and about 70,000 (61,500 in 1962-63) group cows were entered.

Automatic Data Processing of Herd Recording Results.—Processing of Herd Production Improvement Scheme results on the computor has been much more involved and time consuming than anticipated. Printing of the annual herd summaries for both Official and Group Schemes, although six months later than would have been achieved by the old process, has been a major achievement. The 1963-64 summaries are expected to be published before the end of September, 1964.

Some further programming is needed before the Official and Group statistical tables can be had from the machine for publication in book form. Assessment of bulls by the R.G.V. method will then be the only outstanding, major programme so far as the present Herd Production Improvement Scheme is concerned.

Calf Marking Scheme.—This year 13,805 heifer calves were marked under the Scheme, bringing the total so far marked to 113,154. Of the total marked this year, 2,210 were bred by artificial insemination and 52 were merit calves.

Certified Bull Scheme.—This year 424 certified bull certificates were issued.

Sire Survey.—The data, hand processed, is providing a token service. It has been a great aid to bull selection for the Artificial Breeding Station. Ninety new bulls have been surveyed and a further 100 have been up-dated.

Solids-Not-Fat Recording.—The project continued with some 1,000 privately owned cows and 250 Departmental cattle.

Due to the increasing pressure by the Milk Board, quality of milk is being highly publicised. One result is that public demand for a fuller solids-not-fat recording service is gaining impetus. Further, data already accumulated by the project are ever increasingly demanded by the Department's extension workers and by breed societies.

Departmental Dairy Herds.—Supervision of the herds at Research Stations and the Colleges was somewhat disturbed through transfer of Mr. C. J. Levick to a District position and the untimely death of Mr. G. J. Lloyd in a motor accident.

Production from the herds was very satisfactory. It is expected that data from the Wagga, Yanco and Hawkesbury herds will show that these exceeded an average of 400 lb. butterfat per cow.

Competition results were again very satisfactory at the 1964 Sydney Royal Show. Hawkesbury Agricultural College was the most successful exhibitor in the Jubilee Friesian Exhibit. Yanco Research Station and Wagga Agricultural College also gained substantial shares of the awards.

A Polled Jersey team from the Grafton Agricultural Research Station's Project Herd was exhibited at Sydney Royal Show for the first time. The exhibit created great interest both among breeders and commercial dairymen.

At the Sydney Royal Show sales a heifer from Hawkesbury Agricultural College achieved a sale record of 700 guineas, and a Yanco Research Station bull established a Guernsey record price of 310 guineas.

Demand for stock from all of the Department's Studs has been high. At Hawkesbury, Wagga and Yanco the demand has exceeded the available supply of young bulls and females.

Dairy Industry Research

The Division continued to endeavour to meet the demands for research in the dairying industry. There is further reference to dairy industry research in the Hawkesbury Agricultural College and the Biology Branch sections of this Report of the Department, also in Plant Industry and Animal Industry Divisions' sections.

Development of a rapid method for determining the composition of milk is proceeding. Butter and cheese quality are under active investigation. An officer seconded to the New South Wales Milk Board is studying problems of trace metals and oxidation in milk.

On the husbandry side, research continued into the problem of mastitis and milking machine efficiency and management. A further appointment has recently been made, to expand this work and work also on the topical problem of the solids-not-fat composition of milk.

The milking machines survey continued to reveal a high proportion of inefficient machines. Development of standards of performance of machine components and materials continued.

Efficiencies of detergents and sanitisers are also under investigation. This will lead to formulation of standards.

Research facilities have been increased and are to be further improved. The milking research unit has recently been completed. Plans are well advanced for construction of a laboratory and administration building adjacent to the School of Dairy Technology at Hawkesbury College, to bring together all officers engaged in technology research.

A further dairy research officer has been appointed, to work on mastitis and similar husbandry problems. The complement of officers engaged on dairy research at Hawkesbury Agricultural College now totals seven; two supported by the Australian Dairy Produce Board, three financed from Departmental funds (including a dairy chemist from Division of Science Services), one on secondment to the New South Wales Milk Board, and another stationed at Head Office.

DIVISION OF SCIENCE SERVICES

Biology Branch

General

Overseas Visits.—Two plant pathologists are overseas. Mr. K. E. Hutton is at East Malling, U.K., by invitation; working in collaborative research on apple black spot, particularly in relation to control in the dormant stage by the method he had developed in New South Wales. Mr. P. Kable is at Cornell University, U.S.A., continuing post-graduate studies.

Visitors from Overseas.—Two eminent Japanese mycologists, Dr. Yosie Kobayasi and Dr. K. Tubaki, used the Biology Branch as scientific headquarters in November, December and January. They made collections of fungi in eastern Australia and examined specimens filed in the Branch's Herbarium.

Mr. E. C. Large, a world authority on methods of assessment of damage caused by plant disease and methods of prediction of plant disease outbreaks, particularly in relation to spray warning services, spent some time at the Biology Branch.

Honour for Senior Biologist.—The Senior Biologist, Dr. L. R. Fraser, was made a Fellow of the Australian Institute of Agricultural Science, in recognition of her contributions to solution of citrus disease problems.

New Laboratory.—An air conditioned laboratory where seedling testing can be carried out under artificial light and at constant temperatures has been constructed, to facilitate the work of the soil bacteriology section. Donations from manufacturers of rhizobial cultures for the inoculation of leguminous seed made it possible.

PLANT PATHOLOGY SECTION

New Plant Disease Records

Seventy-three new plant diseases were recorded in this State.

Twenty-five were new host records of *Meloidogyne* spp., the root knot nematodes; reflecting increased attention to plant parasitic nematodes. These new records of *Meloidogyne* spp. will be subject of a separate publication.

Onion yellow dwarf virus (Melhus *et al.* 1929) was recorded for the first time in N.S.W. on onions at Griffith. Glasshouse transmission tests were positive.

New safflower diseases were recorded. These included: rust *Puccinia carthami* Cda., recorded from both northern and southern districts; leaf spot, *Cercospora* sp., resembling the description of *C. carthami* (H. & P. Sydow) Sund. & Ramak given in Chupp's Monograph of this Genus; and root rot, *Phytophthora* sp. Rust is one of the most important diseases of safflower in the U.S.A.

Increased interest in tropical legumes on the north coast has revealed several diseases: root rots caused by *Macrophomina phaseoli* (Maubl.), Ashby, *Rhizoctonia* sp. and *Sclerotium rolfsii* Sacc.; and leaf spots caused by *Ascochyta* sp. and *Cercospora* sp.

Another interesting record was downy mildew, *Sclerospora* sp. on sorghum.

On grapes, a most interesting new record was a *Phytophthora* root rot of Du Lot grape stock. This disease was first recorded in a vineyard at Orchard Hills but has subsequently been seen in other coastal areas.

On ornamental plants, carnation leaf rot caused by the fungus *Heteropatella valtellinensis* (Trav.) Wollenw. was recorded for the first time in N.S.W., in a commercial planting at Cronulla. Another interesting record was the leaf nematode *Aphelenchoides fragariae* (Ritzema Bos 1890) Christie 1932, associated with the ink disease of the native kangaroo paw *Anigozanthos* sp.

The Biology Branch Herbarium

The Biology Branch Herbarium at Rydalmere is now listed in the new edition of the Index Herbariorum, published in 1964. Its standard abbreviation is DAR. This herbarium contains more than 13,000 plant disease and fungal specimens from Australia and overseas. Exchanges of specimens with overseas institutions would be welcomed.

This year the accessioning of specimens has progressed but no work has been done on preparation of a comprehensive card index. Several loans were made to overseas workers for systematic studies.

The Check List of Plant Diseases in N.S.W.

For publication, several sections of the check list have been completed and preparation of the remainder is proceeding.

Investigations of several systematic problems concerning plant parasitic fungi were continued. As part of this work, several important type specimens were borrowed from Australian and overseas institutions. These have enabled the sorting out of some identity problems, and results are now being prepared for publication.

Identifications of Fungi

Several higher fungi were received for identification. Further evidence of a poisonous mushroom on the north coast included mushroom fragments obtained from the stomachs of three people showing symptoms of poisoning. The fungus was not a species of *Agaricus* but in certain features resembled a species of *Psilocybe*. *P. cubensis* which is suspected of being poisonous is known on the north coast of N.S.W. (Aberdeen & Jones, *Aust. J. Sci.* 21: 149, 1958).

Nematology Collection

The recently started collection of nematodes and nematode-infested plant material now contains 138 specimens. The aim is to develop a reference collection of plant parasitic nematodes of importance or potential importance in New South Wales. Some of the more interesting matters relating to specimens added to the collection this year were as follows.

Apelenchoides fragariae was recorded for the first time on *Anigozanthus manglesii* (kangaroo paw) and on *Streptocarpus* sp.

A population of *Aphelenchoides* from poorly producing mushroom beds at Picton was identified as *A. composticola*, a species not reported before in New South Wales. *Trichodorus porosus* and *T. teres* were identified from soil from around citrus trees with a stubby root condition. This is the first record of these two species in New South Wales. A possible pathogenicity of *Trichodorus* to citrus is being investigated.

Cereal Diseases

Wheat Diseases.—Barley Yellow Dwarf Virus (BYDV) is a disease of significance in New Zealand, and to determine its effect on wheat yield in New South Wales some of the major wheat areas were surveyed. This revealed that the disease is widespread—mainly on plants scattered through the affected crops.

Biometrically designed experiments have been set up at Tamworth and Condobolin to determine what reduction in yield of wheat is caused by BYDV and in what part of the season most infection occurs. Insect traps have been set up to find out when vectors are present and in what numbers.

It is of interest that towards the end of the last season several crops in the north-west contained patches of BYDV. An examination of the roots at the same time showed no evidence of any root rot. However, the same patches were examined a month later when the crop had hayed off and the roots and basal crowns were found to be infected with *Fusarium* and *Helminthosporium* species commonly implicated in the root rot complex of wheat.

Flag smut (*Urocystis agropyri*) was in earlier times one of the most serious diseases of wheat in New South Wales but following widespread use of resistant varieties it almost disappeared. Since the introduction of the susceptible Gabo-Gamenya-Mengavi lines into northern wheat areas the situation has changed. Flag smut is reappearing and causing concern.

In a glasshouse experiment to test the efficiency of tetrachloroni-troanisole (TCNA) for control of soil and seed borne flag smut and bunt infections the amount of infection in the controls made the results worthless.

The test is now being repeated in the field with flag smut only at Tamworth. It includes also an attempt to determine the optimum dosage rate of dust, using standard rates of an organic mercurial and of hexachlorbenzene as a comparison.

Wheat, barley and oats leaf spot (*Podosporiella verticillata* associated) was first found on oats two years ago. It has since been found on wheat, barley and ryegrass. During July and August it was commonly found on wheat, barley and oats in a number of wheat areas. It is not regarded as a very serious disease. Its incidence may have been increased by the unusually wet winter of 1963. The associated fungus has been consistently isolated from the leafspots but pathogenicity has not yet been established. Interest is vested in the possibility that it may prove to be a new cereal disease record.

Sorghum Diseases.—The absence of serious lodging in ybrid sorghum crops contrasted with the previous year's erious lodging in the north west. Most of the affected plants ave been apparently free from pathogenic organisms except here charcoal rot (*Macrophomina phaseoli*) has been the ause. The opinion that lodging is a genetic phenomenon nfluenced by seasonal conditions is further supported by the ontrast in the two seasons. In the previous year excellent onditions for early growth were followed by moisture stress uring the last three months of growth. This year the stress vas absent. Lack of lodging could have been due to the tronger stems being able to carry the increasing weight of he maturing heads.

Maize Diseases.—A chlorotic striping of the sweet corn ariety Iochief has worried growers for the last two or three easons. It was thought possible that this condition was due o a genetical abnormality. Further evidence this season has ubstantiated this view.

The striping has only been found in Iochief in commercial rops. However, when breeding blocks of the inbred parents of Iochief were examined, all plants of the female parent vere showing this striping. Male plants growing alongside had no evidence of it. This would indicate that the striping n Iochief sweet corn is a genetical abnormality transmitted hrough the female parent.

Rice Diseases.—Intensive field and laboratory examinations of rice growing at Hawkesbury Agricultural College were made when an unusual condition was suspected of being rice blast (*Pyricularia oryzae*). However, the disease was of physiological origin. Rice is still free of parasitic disease in New South Wales.

Diseases of Other Field Crops and Pasture Plants

Ryegrass Blind Seed Disease.—This disease, caused by *Gloeotinia temulenta,* was first recorded in New South Wales two years ago. It was thought that the disease had probably occurred here for a number of years but that weather conditions prevent it from becoming important. This season the disease was found in three separate seed samples from one grower at Nowra, the only record during the season.

A Patch Disease of Turf.—The common turf diseases brown patch and dollar spot occur regularly but for a number of years now there has been a patch disease that did not fit the symptoms of either brown patch or dollar spot and from which their causal fungi could not be isolated.

This patch disease has been very prevalent this year in couch, bent, blue couch and kikuyu turf, and a fungus has been repeatedly isolated. The fungus was first isolated from turf two years ago but progress with regard to identity and pathogenicity of the fungus was not made until this year.

The work is far from complete but there is evidence that the fungus is the cause of a number of the unidentified patch diseases regularly occurring in turf.

Tobacco Diseases.—A randomised block trial, replicated thrice, to assess the control of blue mould (*Peronospospora tabacina*) by some commercial fungicides was carried out on a grower's property at Ashford. The fungicides were zineb, maneb, dithane M-45 and allisan 50, each at two rates; 1½ lb./100 gallons, 3 lb./100 gallons. Results are now being analysed by the Biometrician.

Seedling infection is normally controlled by benzol fumigation; a tedious and somewhat dangerous operation. Preliminary observations have been made at the New England Agricultural Research Station on the efficiency of zineb sprays alone in controlling seedling diseases. A trial was laid out comparing several thiocarbamate fungicides with benzol for the purpose. Unfortunately, weather did not favour blue mould infection. No result was obtained.

Tobacco Mosaic Virus is becoming more important each year. Inadequate attention to hygienic precautions is the main reason for its spread.

Barn rot (*Rhizopus oryzae*) caused losses up to 25 per cent in some barns in the Ashford district. Inadequate ventilation led to most of the losses.

Spotted Wilt (virus) and Bid Bud (virus) were observed but are not economically important.

Brown Spot (*Alternaria* sp.) appeared at the end of the growing season, fairly widespread, but coming late in the season it does little damage and does not warrant special control measures.

Cotton Diseases.—The cotton acreage is increasing spectacularly in New South Wales but pathogenic diseases are so far only of minor importance here.

Bacterial leaf spot (*Xanthomonas malvacearum*) is widespread and can be troublesome. Collections of diseased leaves made by the plant breeder at Narrabri this season have been sent to U.S.A. for strain identification.

Wilt (*Verticillium dahliae*) is present and can be quite serious as crops mature. The fungus responsible for *Fusarium* wilt of cotton has not been recorded in New South Wales as yet.

Linseed Diseases.—Pasmo (*Septoria linicola*) was the only disease recorded this season. It was very common but only at a low level in most crops.

Soybean Diseases.—Soybeans are only of minor importance in New South Wales. No disease of note was recorded this season.

Sunflower Diseases.—No disease was recorded on this host.

Stem Rot of Cowpeas.—Stem rot (*Phytophthora vignae*) seriously damages cowpeas on the north coast. The disease is so bad in some areas that most cowpea varieties cannot be grown economically.

Until this year, the varieties Malabar and Havana had shown field resistance on the north coast but a survey this season showed stem rot in one block of Havana cowpeas. The fact that Havana had been resistant until now suggests that a new strain of *Phytophthora vignae* has developed on the north coast. This possibility is now under investigation.

Glycine Javanica Diseases.—The *Cercospora* leafspot recorded for the first time in the previous season was widespread again this year. The disease occurs late in the growing season. Economic loss is not great.

Clover Diseases.—Various fungal leaf spots, virus infection and nematode infestations occurred again on clovers. Except in isolated stands these diseases were of only minor importance. There was no record of abnormal outbreaks.

Lucerne Diseases.—Isolates of *Phytophthora cryptogea* (?) from lucerne specimens have been examined in glasshouse studies. Their ability to cause seedling root rot and root rot in more mature plants has been demonstrated. The pathogen is thought to be widely distributed in N.S.W. and a survey may be implemented in the coming Spring.

Vetch Diseases.—Disease problems in 1963 were a major limiting factor in far north coast vetch production. Previously, except for 1958, they were not very significant.

The nature of the diseases appeared complex when first investigated, mainly because of inadequate opportunity to observe them in their early stages. Therefore a plant pathologist has been stationed at Wollongbar Agricultural Research Station, to follow the field developments.

Preliminary studies indicated a number of diseases affecting vetch but that only two, *Fusarium* root rot and a virus, were significant. Field work has been directed at: (*a*) an assessment of the importance of disease in vetch, (*b*) isolation and demonstration of the causes, (*c*) an examination of agronomists' observations that later sowing dates could effectively avoid serious losses in most years.

So far, thirty farms have been inspected in a survey on the Wollongbar plateau. From this it is apparent that the disease problems are far less severe than in the previous year, though to some extent present in all crops. Laboratory examinations are proceeding.

At this stage the causes of the diseases have not been conclusively demonstrated; except that field experiments have shown the soil-borne nature of the root rot organism(s); that they are natural soil inhabitants and can be found in land not previously sown to vetch but are significantly more prevalent in old vetch lands.

Next season's work will turn more towards laboratory and glasshouse studies and will also investigate possible tolerant strains of Golden Tares vetch.

Diseases of Vegetable Crops

Potato Seed Certification.—Records compiled by the Division of Plant Industry showed that no crop was rejected from certification on the northern or southern tablelands because of excessive content of leaf roll or other virus diseases. One four acre crop of Sebago was rejected on the northern tablelands because of excessive content of blackleg (*Erwinia atroseptica*).

On the central tablelands, seven crops comprising 7¾ acres were rejected from certification because of excessive content of virus leaf roll. Following many rejections of 1962-63 season crops in the central tablelands because of leaf roll, a number of growers are now adopting aphicidal control measures to prevent build up of vectors in the certification crops.

The Biology Branch is co-operating with Division of Plant Industry to build up foundation stocks of a number of varieties at the Potato Research Station, Orange, as a source of seed for growing for certification. Plants showing leaf roll or other virus diseases are rogued and a strict schedule of systemic aphicides is applied to the plants.

Potato Late Blight (Phytophthora infestans).—This was of little importance in the 1963-64 season. Infections occurred in the Sydney area in the late spring of 1963 but caused little crop loss.

In co-operation with Division of Plant Industry, the project continued for development of potato varieties immune to late blight. The year's results showed six agronomically promising seedlings immune to the "o" race of *P. infestans.* The American blight-immune varieties, Merrimack, Pungo and Tawa, were each a parent of two seedlings.

Potato Common Scab (Streptomyces scabies).—Work in co-operation with Division of Plant Industry continued for development of scab resistant varieties. In the 1963-64 crossing programme by the potato breeder at New England Agricultural Research Station the scab resistant varieties and seedlings F4724, Norland, S2886, Blanca, Haig, Huron, Navajo, Menominee, Ontario, and B595-76 were used as parents.

Because of the predominately dry season there was high incidence of common scab on the central tablelands, where the scab resistance trial at Spring Hill was carried out.

In this trial, varieties' and seedlings' scab reaction ratings were calculated on the severity of scab lesions and a scab index number (maximum 4) was then calculated for each variety and seedling. The results were as follows: Norland (a scab resistant variety ex U.S.A.) 0.39; S2901 (Monak x 11-79 x Merrimack) 0.55; S2904 (Scab Resistant U.S.D.A. Seedling B595-76 x Smooth Rural x Katahdin) 0.71; S2902 (Delus x Redskin, a scab resistant variety ex U.S.A.) 0.75; S2881 (Awaba x 336-123, a scab resistant seedling ex U.S.A.) 1.06; S2884 (Murru, scab tolerant, x Adina) 1.43; S2864 (Monak x 11-79) 1.57; Sebago 1.61; S2897 (Redskin-natural pollination) 1.64; S2885 (Awaba x 336-123) 1.90; Exton 3.03. The very susceptible Exton control showed a high scab index number. High scab resistance was shown by this Department's seedlings S2901, S2902, S2904.

Potato Rugose Mosaic (Potato Virus X and Potato Virus Y).—Tests to determine the field reaction of four advanced seedlings to aphid infection by Potato Virus Y (PVY) continued. Three seedlings, S2879, S2882 and S2883, all derived from the cross Monak x 11-79, showed a leaf drop streak reaction to PVY. A fourth seedling, S2869, derived from the same cross, was highly field susceptible and when infected reacted by producing a mosaic pattern on the foliage.

Tomato Yellow Top (Tomato Yellow Top Virus).—This season the disease was of no economic importance, due to commercial growers' general adoption of the rigorous aphicidal programme shown by this Department to effectively control field spread of the disease.

Tomato Fusarium Wilt (Fusarium oxysporum *f.* lycopersici) and *Verticillium Wilt* (Verticillium dahliae).—Cultures of these fungi were supplied to Division of Plant Industry for the programme of breeding resistant varieties.

By establishment of the intra-Departmental Vegetable Improvement Committee there has been close co-operation between the plant pathologist concerned with tomato diseases and the research agronomists concerned with tomato breeding. Reaction of three hybrids to *Fusarium* wilt were tested at Rydalmere. These hybrids, Anahu x Rouge de Marmande, Indian River x Rouge de Marmande, and Step 286 x Rouge de Marmande, were found to be 100 per cent resistant to the disease under the same conditions as Rouge de Marmande showed 90 per cent susceptibility.

The following lines submitted by the research agronomist at Yanco Agricultural Research Station were found resistant to *Fusarium* wilt: Epoch Dwarf Vined, Chico, H.1370, Y.T.M.F.-8, Y.T.M.F.-8ch, TxP.A.-8, TxTxP.A.-8, A-P.A. x M7, B-P.A. x M7, C-P.A. x M7, D-P.A. x M7, V.F.-145, V.F.-145-21-4, and V.F.-145-22-8. The last seven lines were also found to be resistant to *Verticillium* wilt.

The following lines submitted by the research agronomist at Hawkesbury Agricultural College were found to be resistant to *Fusarium* wilt: H.1370(F), H1370 (U.F.), Campbell 146 and Marion VF 36, VF 206. The last two lines and Pearson VF 11 were also resistant to *Verticillium* wilt.

College!

Disease Control by Use of Misting Machines.—Analysis of copper deposit on leaves of trellised tomato plants from the 1962-63 experiment at the Horticultural Research Station, Narara, showed good agreement with previous results. No significant differences in yields of clean fruit were shown between plots receiving a weekly 4 oz. copper oxychloride/2 gallons water misting, a weekly 2 oz. copper oxychloride/2 gallons misting or a fortnightly 4 oz. copper oxychloride/2 gallons misting; although the weekly application of 4 oz. copper oxychloride/2 gallons water gave the highest ratio of healthy to diseased fruit and also greater control of early blight and *Septoria* leaf spot.

In a misting trial on a staked tomato crop at Rydalmere, the standard copper oxychloride treatment (4 oz./2 gallons) at weekly intervals was compared with zineb (3 oz./2 gallons), maneb (3 oz./2 gallons) and dithane M-45 (3 oz./2 gallons). The predominately dry autumn did not favour foliage diseases but there were differences in development of *Alternaria* fruit rot (*A. tenuis*) as between the untreated and the various treatment plots, viz.: untreated, 15.3 per cent fruit rot; copper oxychloride, 9.2 per cent; zineb, 6.7 per cent; maneb, 8.4 per cent; dithane M-45 8.8 per cent.

Asparagus Decline and Replant Problem.—Work continued at Gundagai in the project to control the three *Fusarium* species parasitic to asparagus.

Seed of a tolerant strain of the Mary Washington variety, from the University of California, was planted at Gundagai in the late spring of 1962. Three separate plantings were made.

One seed lot was planted in a nursery layout in old pasture soil. The plants have reached a stage where agronomically desirable plants will be consolidated into a compact area and their seed will be used for crown production.

The second seed lot was used to produce crowns which have been planted in old asparagus ground and to date are showing little evidence of *Fusarium* attack. The plants are being selected for yielding ability and other desirable characters and seed from them will be used for further glasshouse testing for *Fusarium* tolerance.

The third lot of seed was sown direct into old asparagus ground, and about 30 per cent of the plants have survived. Of these, the most agronomically promising will be planted in a compact area with the seed production plants and seed will be obtained for crown production.

In addition to the work with this imported asparagus seed, seed was collected from vigorous plants remaining in a replant plot in old asparagus ground and was sown in the glasshouse in flats of soil containing the three *Fusarium* species; 0.09 per cent of the resultant seedlings were retained because of vigorous growth and only slight evidence of *Fusarium* attack. These seedlings will be retested in the glasshouse and the survivors used for further seed production.

Bean Seed Certification Scheme.—In co-operation with Division of Plant Industry the Bean Seed Certification Scheme continued for the 21st successive season.

Of 13 crops comprising 51 acres, eight crops were certified. Of the five crops not certified, three were picked green, one crop failed and one was not planted.

There has been further decline in seed production on the south coast, a trend indicated in last year's report.

Root Rotting of Stringless French Beans.—This was again present in crops grown in western and south-western districts for processing. It was less severe than in the previous season. Symptoms include yellowing of the leaves, stunting, and eventual death of the plant. Affected roots generally appear normal externally, but show pale brown to almost black discoloration of the vascular tissue when cut. This discoloration is often confined to the lower roots, but may also be present in the upper roots and at times extends to the first node.

Field observations had suggested resistance in some lines of the stringless varieties currently grown. To investigate this, replicated trials with 16 lines of beans were conducted at Yanco, Canowindra and Gundagai. This was in co-operation with Division of Plant Industry, several canning industry firms, and a seedsman.

Four lines appeared resistant to the disease at all three loca-ions. Another line appeared resistant at Canowindra and a ifferent line appears resistant at Gundagai. Although most nes of stringless French beans are susceptible to the disease ome of the lines which appeared resistant are worth further rial.

The fungi associated with the disease were the same as in revious years; *Macrophomina phaseoli, Fusarium* sp. and, to limited extent, *Pythium* sp. *Rhizoctonia* sp. was also bundantly isolated from plants from one location.

The stringless bean breeding lines produced by Division of lant Industry were again inspected, and noted to be healthy when grown adjacent to the aforementioned trial in which nly four commercial lines were resistant.

Cucurbit Powdery Mildew (Oidium *sp.*).—This is usually he limiting factor in rockmelon production in the M.I.A. and the Lower Murray districts. It was much less destructive his year and occurred only in the late crops.

The rockmelon breeding lines produced by Division of lant Industry at Yanco Agricultural Research Station were nspected.

Some 60 further collections of this disease from a variety of cucurbit hosts from many areas of the State have been examined. All resemble the imperfect stage of *Sphaerotheca fuliginea;* with long chains of conidia, well-developed fibrosin bodies, and a proportion of forked germ tubes. This confirms previous observations that only one species of cucurbit powdery mildew is concerned and this resembles the imperfect stage of *S. fuliginea.*

Further plantings of various cucurbits were made at Rydalmere to determine their reaction to powdery mildew. In the rockmelon planting three varieties, one plant introduction and two groups of breeding lines were immune. Six varieties and three introductions showed some resistance. In the cucumber planting five varieties and three introductions showed some resistance. In the planting of *Cucurbita* spp. one species showed some resistance to powdery mildew.

As in previous years the reaction of these lines at Rydalmere to powdery mildew was similar to that reported in the U.S.A. where cleistothecia of *Erysiphe cichoracearum* had been recorded on cucurbits and where *Sphaerotheca fuliginea* was not known. This prompted an examination of the American cucurbit powdery mildew, and a mildew resembling *S. fuliginea* is now known to be present and even prevalent in the U.S.A. A note on these observations has been published.

Several varieties of rockmelon free from powdery mildew at Rydalmere during the previous season were slightly or moderately affected by the disease this year. Seasonal conditions may have altered the resistance of the varieties or a new race of the fungus may be present.

Sclerotinia Rot (S. sclerotiorum).—There has been no fungicidal treatment recommended for control of this disease which affects a wide range of vegetables, ornamentals and fruit hosts. Recently a new fungicide DCNA (2,6 dichloro-4-nitroaniline) was reported as promising for control of the disease in beans.

In a trial at Padstow, near Sydney, DCNA was compared with pentachloronitrobenzene (PCNB) for the control of *Sclerotinia* rot and grey mould (*Botrytis cinerea*). Each fungicide was used at the rate of 2 lb. of the 50 per cent W.P. per 100 gallons. Incidence of both diseases was relatively low but the weekly and fortnightly treatments with DCNA reduced their incidence. Control of grey mould was better than that of *Sclerotinia* rot. Fortnightly was as effective as weekly treatment. Weekly application of PCNB was as effective as weekly and fortnightly application of DCNA in controlling *Sclerotinia* rot. It was significantly less effective in controlling grey mould than was the weekly DCNA. The fortnightly PCNB did not give significant control of *Sclerotinia* rot, but gave significant control of grey mould. This work has been published.

At Terranora Vegetable Demonstration Plot, DCNA at 3 oz./2 gallons water was applied as a semi-concentrate spray to French beans about two weeks after emergence and at flowering. This programme halved the number of affected plants, but there was still considerable incidence.

DCNA efficiency in reducing "nesting" in beans consigned to the markets was tested by distributing several *Sclerotinia*-affected beans through packs of beans dipped in DCNA and through an equal number of packs of untreated beans. On arrival in Sydney from Murwillumbah there was in most packs very limited development of "nesting" in dipped beans and slight to moderate development in undipped beans. In one instance the dipped beans showed slight development of "nesting", but the undipped beans showed twice as much disease.

Lettuce Necrotic Yellows.—This has been seen in all lettuce crops inspected. In most instances only isolated plants were affected but from time to time more serious losses occurred.

Onion Yellow Dwarf (*Onion Yellow-Dwarf Virus*).—This was recorded for the first time in New South Wales, in the Griffith district during December 1963. All crops inspected showed some infected plants. Some were severely stunted and would yield very poorly. Many of the virus-affected crops were also affected by *Stemphylium botryosum* on the yellow areas of the leaf.

All onions are grown from seed and no seed crops are grown in the district. Thus, diseased volunteer onion plants would be the main means of virus carry-over. The disease should be controlled by destruction of all such volunteer plants.

Mushroom Culture and Mushroom Diseases

The cultivated mushroom industry is near to a stage of very high efficiency, the bulk of the crop being grown indoor where effective environmental control is achieved during all phases. With increased efficiency, shorter composting and associated economy in utilization of compost is more widespread. Quality of mushroom spawn supplied by commercial mushroom spawn producers continues to be satisfactory.

Diseases.—This year there was a new record of parasitic eelworm attacking mushrooms in New South Wales; also a new bacterial disease record for this State.

The eelworm *Aphelenchoides composticola,* shown in England to be a destructive parasite of mushroom mycelium, was recorded at Picton. Heavy yield losses in a number of trays had resulted from destruction of mycelium following build up of heavy populations of the eelworm.

A bacterium of the genus *Pseudomonas* was recorded at Dural, spotting mushroom caps and gills. Biochemical characters of the bacterium, determined by the Commonwealth Mycological Institute, indicated that it differed markedly from the bacterial blotch bacterium *Ps. tolassi,* which has not been recorded in the State. It was not possible to assign a specific name to the Dural bacterium.

Losses caused by mat disease (*Myceliophthora lutea*) and other mushroom diseases and competitors were of little significance, reflecting the increasing efficiency of local mushroom culture.

Citrus Diseases

Following hot weather in January, black spot development was heavier than since 1958 in coastal orchards where the fruit was not harvested early. Wet weather in coastal orchards during autumn and winter 1963 and coastal floods in early June 1964 again stimulated *Phytophthora* diseases. No commercial losses due to *Septoria* spot were reported from inland areas.

Phytophthora diseases.—Deterioration of orchards on rough lemon stock in coastal areas continued and heavy infection of seedling stocks occurred in several nurseries.

Two series of tests for resistance of citrus strains to *Phytophthora citrophthora* root rot were carried out. Strains tested included four *Poncirus trifoliata* x blood orange hybrids, 21 sweet orange, 14 sour orange, 3 mandarin varieties, 5 rough lemon, *Citrus macrophylla, C. taiwanica,* Yuzu, Calamondin, sweet lime and single F1 seedlings of Cleopatra mandarin x *Poncirus trifoliata* (2) and scarlet mandarin x *P. trifoliata* (56).

With the exception of one F1 scarlet x *P. trifoliata,* all of the hybrids showed a satisfactory level of resistance. The F1 seedlings will therefore be propagated for seed production. In the sour orange group the smooth sevilles showed much higher resistance than did bitter rough and bitter sweet strains. Most of the sweet oranges were susceptible but three selections showed resistance approaching that of smooth seville. *Citrus macrophylla* and *C. taiwanica* were only slightly less susceptible than rough lemon, Cleopatra selections were susceptible, including one from Florida; Ellendale and Emperor slightly more resistant. Yuzu, Calamondin and sweet lime were more susceptible than rough lemon. A rough lemon variant with a smoother rind texture and deeper rind colour than the standard variety was slightly less susceptible than it.

Virus Diseases.—The work, as follows, was done in collaboration with officers of the Division of Horticulture.

Grapefruit Stem Pitting.—Observations on the behaviour of mild strain selections under field conditions continued. The results are still encouraging. Additional strains were selected for further field testing.

Scalybutt (Exocortis) and *Stunting of Trees on* Poncirus trifoliata.—Trees of Shamouti orange propagated from buds from vigorous shoots made after severe pruning, have commenced to show scaling of the stock at an age of four years. Buds taken from all parts of the cane including the base and very young soft tips have transmitted the disease.

Buds of Etrog citron have been imported from California for testing as a scalybutt indicator. It is hoped that this will facilitate indexing for scalybutt by shortening the incubation period.

Lemon Crinkle.—*Citrus moi,* under trial as an indicator for psorosis, has proved to be sensitive also to tristeza-stem pitting and its usefulness as an indicator under N.S.W. conditions is in doubt.

Yellow Spotting.—A virus disease universally present in the Meyer lemon in California has been described as Tatter Leaf by Wallace and Drake (1962). On some indicators this virus causes yellow blotching. In N.S.W. the Meyer lemon characteristically shows a blotching of aging leaves. Inoculations from Meyer lemon to Ellendale mandarin have produced yellow spotting of aging leaves similar to that produced by xyloporosis-infected budwood of grapefruit from Florida (see 1963 report). It seems therefore possible that the Florida budwood besides carrying xyloporosis was infected with another latent virus and that this could be Tattler Leaf. There is no evidence so far that the virus is present in N.S.W. in any variety other than Meyer.

Sudden Death (*cause unknown*).—Further isolations have been made of *Coprinus* sp. from sudden-death affected trees on *P. trifoliata,* but no success has been obtained in inoculation trials.

Stubby Root Disease (*Trichodorus* spp.?).—Further observations have been made on the control of *Trichodorus* suspected of causing a stubby root condition in citrus at the Horticultural Research Station, Narara. The seedbed trial at Narara and the glasshouse trial at Rydalmere with the same soil have now been in progress for eighteen months. The trend of results to the present indicates that preplant application of Vapam (sodium-n-methyl dithiocarbamate dihydrate) eliminated *Trichodorus* from the soil and increased the growth of citrus seedlings; Nemagon (1, 2-dibromo-3-chloropropane) preplant and three and six months after planting, and V-C13 (0-2, 4-dichlorophenyl 0, 0-diethyl phosphorothioate) preplant were less effective. Further counts of the *Trichodorus* population are currently being made.

Two species were identified from specimens of the *Trichodorus* population at Narara. These were *T. teres* Hooper, 1962 (*T. flevensis* Kuiper and Loof, 1962) and *T. porosus* Allen, 1957. Mr. D. J. Hooper of Rothamstead Experiment Station kindly made the identifications. *T. porosus* was also found in soil from around unthrifty citrus trees at Yanco.

A survey of citrus nurseries in the Sydney, Gosford and Griffith districts revealed *Trichodorus* in one of seven nurseries in the Sydney district, high populations of the fungus in each of three nurseries in the Gosford district, which includes Narara, but none in samples from two nurseries at Griffith.

Further study of *Trichodorus* distribution and taxonomy in N.S.W. is planned.

Black Spot (Guignardia citricarpa).—The black spot spraying trial was continued on 25 years old Valencias at Mangrove Mountain. Seven fungicide programmes (3 sprays) were compared. As in previous seasons, information was collected on disease control, yield and aspects of fruit quality.

An interesting outcome was the comparative failure of the three-spray zineb programmes (2 lb./100 gals., 65 per cent. wettable powder) to control black spot in a year when incidence was very severe. Addition of 0.25 per cent. white spraying oil to the zineb sprays improved black spot control by over 10 per cent but this difference could not be established as significant. The zineb-oil programme as well produced fruit that was also more attractive and of uniform colour, though pulp flavour was less satisfactory than that of fruit from the zineb (no oil) programmes.

Percentages of clean fruit at harvest were as follows:—Bordeaux mixture 2½-2½-100-oil (3 applications) 77 per cent; Bordeaux mixture 2½-2½-100-oil (2 applications) followed by zineb, 75 per cent; copper oxychloride + lime (2 applications) followed by zineb, 70 per cent; cuprous oxide + lime (2 applications) followed by maneb, 70 per cent; Bordeaux mixture 2½-2½-100-oil followed by zineb (2 applications), 66 per cent; zineb-oil (3 applications), 65 per cent; and zineb (3 applications), 56 per cent. The full zineb programmes provided less control of black spot than did the copper fungicides.

Two spray applications of Bordeaux mixture 2½-2½-100-oil followed by a final spray application of zineb gave as satisfactory control of black spot as the three-spray programme of Bordeaux mixture 2½-2½-100-oil. However, the former programme produced fruit with superior appearance and satisfactory juice characteristics. No significant differences could be established for yield or size of fruit.

The spraying trial on 23 years old Valencias at Jilliby was continued. In the past season 14 programmes (3 spray applications) were compared. Black spot incidence was very severe and the trial provided an excellent opportunity to compare a number of proprietary fungicide materials.

Percentages of clean fruit at harvest in January, 1964 were as follows:—Copper oxychloride-lime-oil (3 applications), 92 per cent; weak Bordeaux mixture-oil (2 applications) followed by zineb-oil, 86 per cent; cuprous oxide-oil (2 applications) followed by zineb-oil, 85 per cent; copper oxychloride-lime-oil (1 application) followed by zineb-oil (2 applications), 80 per cent; Bordeaux mixture 5-5-100-oil (1 application) followed by zineb-oil (2 applications) 80 per cent; zineb wax (3 applications), 75 per cent; zineb-oil (3 applications), 74 per cent; Bordeaux mixture 2½-2½-100-oil (1 application) followed by zineb-oil (2 applications), 71 per cent; cuprous oxide-oil 1 application) followed by zineb-oil (2 applications), 71 per cent; zineb (3 applications) 63 per cent; trioneb (2 applications) followed by zineb (1 application), 63 per cent; polyram kombi (2 applications) followed by zineb (1 application), 60 per cent; and cuprous oxide-lime-oil (1 application) followed by maneb (2 applications), 60 per cent. A programme of delan (dithianon) followed by zineb gave 89 per cent disease-free fruit but the severity of spray burn on the rind reduced all the treated fruit to factory grade.

Under conditions of severe test it was obvious that zineb did not provide as satisfactory control of black spot as did the copper fungicides, nor did it provide adequate control of melanose. For these reasons zineb is not recommended for use in a petal-fall spray application. Fruit on trees that had received three applications of zineb each season over several years were observed to be more severely affected by melanose than were trees which had received copper-fungicides each year.

Generally, internal fruit was very satisfactory. Deleterious effects of dithiocarbamate sprays applied to Valencia trees on light sandy soils at Mangrove Mountain were not observed in the trees on the heavier alluvial soils at Jilliby.

Surface blemish caused by spraying with copper oxychlorides is minimised by the addition of a small quantity of hydrated lime to the copper oxychloride-oil spray.

The copper oxychloride-oil-lime treatment proved very promising in the present trial, giving good control of black spot and melanose together with satisfactory yield and appearance of fruit.

A screening trial of a number of fungicides was continued at the Horticultural Research Station at Narara.

Percentages of clean fruit at harvest late in December, 1963, were as follows: Bordeaux mixture 2½-2½-100-oil, 87 per cent; Cuprox-lime-oil, 86 per cent; Cuprox-oil, 80 per cent; oleocuivre, 79 per cent; zineb-oil, 74 per cent; coprantol, 73 per cent; cuprox-lime (nil oil), 73 per cent; crag 658, 71 per cent; cuprox (nil oil), 70 per cent; perenox-maneb x 2, 68 per cent; perenox-lime, 57 per cent; perenox, 49 per cent; maneb, 48 per cent; phygon, 48 per cent; niacide A, 35 per cent; polyram kombi, 35 per cent; and niacide M, 25 per cent.

Aspects to be considered when recommending for black spot control are: the need to minimise the number of spray applications; control of white wax and other scales and mites, and minimising of their build-up; avoidance of accentuation of rind blemish; retention of satisfactory fruit quality and appearance; and an assured economic return to the grower for his efforts.

Those considerations and the results of field trials conducted over the period 1959-62, support the following alternative recommendations for lowland orchards—in the central coast area of New South Wales—located on alluvial soil: The petal-fall spray—Bordeaux mixture 5-5-100 to which one quart of mayonnaise type white spraying oil is added; the second and third spray applications—zineb 2 lb. per 100 gallons, to be applied 6 and 13 weeks after the initial spray application (white oil, or white oil-malathion may be added with safety to either of these zineb sprays).

Brown spot of Emperor mandarin (Alternaria citri).—The etiology of brown spot disease of Emperor mandarin has been subject of considerable interest for many years. The anthracnose fungus *Colletotrichum gloeosporioides* is frequently sociated with brown spot lesions and was formerly conlered casual, but infection studies failed to establish its thogenicity.

By special techniques an *Alternaria* type fungus has been nsistently isolated from brown spots on leaves, twigs and uit of Emperor mandarin. Inoculation studies have estabhed this fungus as the pathogen. Typical lesions developed n Emperor mandarin leaves in four days and on young uits in two days.

The fungus closely resembles *Alternaria citri* but isolates of *lternaria citri* from centre rot of Washington navel fruits e not pathogenic on Emperor mandarin leaves or fruits. rovisionally the organism responsible for Emperor mandarin rown spot has been ascribed to a specialised form of *lternaria citri,* Ellis and Pierce.

In a spraying trial on young Calamondin plants at the orticultural Research Station, Narara, six treatments and an ntreated control were compared:—copper oxychloride,Boreaux mixture, ziram, melprex, thiram, lime sulphur, and il treatment. Four spray applications were made at approxiate monthly intervals from December to May.

On the basis of mean twig infections per plot, assessed in id May, thiram (8.4) and ziram (13.8) were superior to elprex (15.6), cuprox (16.4) and Bordeaux mixture (16.6). here was no significant difference between lime sulphur 25.0) and nil treatment (29.0). Differences were assessed t 0.05 level of probability.

Citrus Nutrition.—The citrus nutrition pot experiment, colaborative with Chemistry Branch and Division of Horticulture, ended this year. The data on yield, aspects of ruit quality and leaf analysis for the three years 1959, 1960 nd 1961, have now been examined and assessed. A research aper is in process of preparation.

Planting material will be available in the coming spring vhen further aspects arising out of this investigation will be xamined.

Lemon Scale Disease (Sphaceloma fawcettii).—No trial was ndertaken during past season.

Diseases of Deciduous Fruits

Apple Black Spot (Venturia inaequalis).—Control was generally satisfactory. Ascospore liberation studies were continued at Orange in association with the Division of Horticulture Spray Warning Service. No detailed experimental work has proceeded in the absence overseas of the particular pathologist. He is currently at East Malling, England, by invitation, collaborating in similar work there.

Virus Diseases of Pome Fruit.—Tests for transmission of a number of suspected virus diseases were continued at Narara. Observations revealed inconclusive signs of transmission of symptoms. Observations are continuing.

Indexing tests at Rydalmere resulted in transmission of two latent apple viruses which do not produce visible symptoms on the commercial varieties wherein they were detected. This is the first time latent pome fruit viruses have been detected and transmitted in New South Wales.

Indexing of recommended apple budwood source trees on a large range of standard apple virus indicators has been started. Results from these experiments should be known during the next two seasons. Due to the large range of indicators and the limited number of seedlings available at the time only one tree of one variety (Red Jonathon) is being used for indexing this year.

At the same time buds from the Red Jonathon were subjected to heat therapy (100°F. for 30 days) at different times after budding. Growth from each of these buds is to be re-indexed on a complete indicator range to determine what viruses were eliminated by heat-therapy.

An unusual leaf-flecking has been recorded on pears growing in an orchard at Orange. The symptoms are thought to be caused by a new virus or due to infection by a cherry virus. To find the cause of the flecking an experiment to identify what viruses are present in the affected pear trees has been set up.

The Deciduous Fruit Tree Improvement Committee continued its work, and by orchard surveys a number of budwood source trees have been eliminated from the lists of recommended trees supplied to nursery men.

Surveys by field officers have yielded new records of virus and suspected virus diseases of pome fruit.

Fungal and Bacterial Diseases of Stone Fruit.—Most of the research has been in abeyance due to the particular pathologist's absence overseas.

Virus Diseases of Stone Fruit.—Mahaleb cherry trees subject of heat therapy immediately after budding into seedling stock in 1962 have still shown no evidence of virus infection. When there are sufficient buds on the heat-treated plants they will be indexed to determine their virus content.

To investigate cherry dieback on Mahaleb stocks a supply of virus-free Mahaleb seed has been obtained from America. Layout of a field experiment to be done in association with Division of Horticulture has been partially decided. This is for determination of the horticultural aspects of the rootstock-scion combinations, and assessment of the viruses involved.

Thirteen of the recommended sources of cherry budwood were indexed on peach and cherry seedlings in the 1962-63 season to determine presence or absence of viruses. Results showed that eight were virus infected and the indexings of the remaining five will be kept under observation next season.

The eight trees which indexed positive for virus have been eliminated from the list supplied to nurserymen. Surveys will continue to find alternative budwood sources.

The Deciduous Fruit Tree Improvement Committee continued to function. Inspections this year have resulted in rejection of more trees due to visible signs of virus infection.

The collection of standard stone fruit virus indicator hosts has increased. A start to identify positively what viruses are present on stone fruits in New South Wales should now be possible.

Diseases of Tropical Fruits

Banana diseases.—Investigation of most diseases of tropical fruits is in abeyance, following resignation of the far north coast plant pathologist.

Banana Bunchy Top (Virus).—The overall incidence of this disease has been maintained at a low level.

Banana Heart rot.—This disease, of undetermined cause, is more common than usual in the Coff's Harbour area. Bacteria are associated as is some evidence that cold injury may be a predisposing factor. A suggestion that imbalanced nutrition may be of primary importance is being followed up experimentally. Results are not expected for at least three years.

Passionfruit Fusarium Wilt.—In co-operation with Division of Horticulture a breeding programme to incorporate the field resistance of *Passiflora edulis* f. *flavecarpa* with the desirable agronomic characters of the black passion vine (*P. edulis*) has been proceeding for some years. Based on field resistance last summer, six vines were chosen from an open pollinated planting (F4 generation) of several acres at North Kulnura. Cropping capacity and desirable field characteristics were selection factors. Flowers on the selected vines were selfed and, despite a considerable degree of self-sterility, seeds were obtained. These seeds have been sown. Good germination resulted. The young plants will be inoculated with *F. oxysporum* f. *passeflorae* prior to planting out at North Kulnura in *Fusarium* infested soil.

Diseases of Grapevines

Downy Mildew.—Conditions were very wet in coastal districts up to November but only light downy mildew incidence occurred. Dry conditions prevailed in all districts after November and kept infections low.

In a demonstration at Orchard Hills all sprays controlled the disease equally well, because of low incidence of the disease.

Phytophthora Root Rot.—Following two successive wet coastal winters several instances of a root rot of resistant rootstocks, caused by *Phytophthora* sp., have been recorded.

The most severely affected variety Du Lot (*Vitis rupestris*) is the rootstock most commonly used in grape-growing areas around Sydney. This variety does not do well on heavy soils and under conditions of poor drainage. All cases so far reported have been associated with poor drainage. It seems likely that *Phytophthora* is the factor which leads to poor growth of Du Lot under these conditions.

Phytophthora has also been isolated from other *Phylloxera*-resistant rootstocks, none so severely affected as Du Lot.

These records are the first of *Phytophthora* causing a root rot of grapes in New South Wales, but the disease is regarded as having been present for years in coastal districts.

Dead Arm.—Large numbers of vines of the varieties Doradillo and Ouilliade on several properties at Griffith, M.I.A., died as a result of severe arm and butt infections by *Phomopsis viticola.* Recurrence of this disease after some years of quiescence followed a very wet winter.

Grape Vine Bunch Stem Dieback.—The experiment to determine the relationship, if any, of bunch stem dieback and nutrition of the vine has been continued, without positive results.

Diseases of Strawberries

Black Root Rot.—In a trial at Narara none of the tested soil treatments controlled black root rot successfully.

Nematode extractions from soil have failed to reveal any nematode species likely to be implicated. A large number of isolations from diseases and healthy roots revealed a number of fungi reported as pathogenic on roots of strawberries and other plants. Investigation is continuing.

Diseases of Ornamentals

Seedling Diseases.—Incidence of seedling diseases in commercial nurseries is much less now. More growers are resorting to heat sterilizing of soil and to other practices which help to produce disease-free stock.

Interest in the steam-air treatment of soil and seed has increased. Biology Branch may soon be in a position to advise on this relatively new technique. Part of the equipment for this research has already been acquired.

Mosaic of Cymbidium Orchids.—This is increasingly common in the metropolitan area. It has also been recorded from the Hunter and Illawarra districts. Propagation from infected plants is a major means of spread.

Azalea Leaf Gall (Exobasidium vaccinii).—This was reported from several places within the metropolitan area.

Flower Blight of Azalea (Ovulinia azaleae).—This was widespread in the metropolitan area in October and was poorly controlled by common fungicides.

Bacterial Gall of Oleander (Pseudomonas torelliana).—The gall was reported from several places in the metropolitan area and in country districts.

Carnation Wilt (Fusarium oxysporum *f.* dianthi).—It caused severe losses in commercial nurseries in the metropolitan area.

Powdery Mildews (Oidium *spp.*).—Severely attacked Begonia, Chrysanthemum, Hydrangea, Crepe Myrtle, Dahlia and Sweet Pea.

Rhizoctonia Collar Rot.—Caused heavy losses in a commercial planting of Chinese Aster at Liverpool and was severe on carnation crops in the Liverpool and Gosford areas.

BACTERIOLOGY SECTION

Lectures at Hawkesbury Agricultural College

The vacancy resulting from the death of the Lecturer in Microbiology at Hawkesbury Agricultural College early in 1962 was not filled until February, 1964. Biology Branch bacteriologists had spent three days per week delivering lectures and conducting practical classes in dairy and food microbiology, in the interim. In the 1963 academic year this entailed 406 actual teaching hours, and considerable time in reorganising the curriculum and selecting equipment for laboratory additions or replacements.

Dairy Bacteriology

Cheese Starter Cultures.—A record number of 1,704 cheese starter cultures were distributed to cheese and other cultured products factories in N.S.W. Increased awareness of the industry for rigid control of starter culture propagation techniques, including use of active cultures, is reflected by demand for pure single strains of lactic streptococci; 940 cultures were supplied in 1960-61; 1,031 in 1961-62; and 1,456 in 1962-63.

Biological Cheese Quality.—A comprehensive survey of the biological quality of all cheese varieties manufactured in N.S.W. has commenced. Regular monthly samples are taken at the producing factory and forwarded to the laboratory for determination of coliform and staphylococcal numbers. Manufacturing data for each sample are taken and being used for proposed amendments to regulations governing the pasteurisation of milk intended for cheese manufacture. The results of the examinations are being forwarded to field officers for advisory work to improve cheese quality.

This programme is complementary to those reported in 1961, 1962 and 1963.

Butter Quality.—Bacteriological analysis of N.S.W. butter was continued. During the main producing months, October to April, regular weekly samples from all factories were examined. Total, coliform, casein digester, staphylococcal and yeast and mould counts were performed. A record number of 808 samples were analysed. Results were conveyed to field officers for special advisory work to improve the hygiene of butter manufacture.

Antibiotics in Dairy Produce.—Regular testing of suppliers' milk for residual antibiotics was discontinued. As a result of previous years' work which has involved inter alia the investigation of detection techniques, several factories now have regular testing programmes as part of quality control operations. These factories' results are subject to examination by the Bacteriology Section of Biology Branch.

A new group of antibacterial agents for use in mastitis therapy has appeared recently in the Australian dairy industry. These agents, the nitrofurans, are claimed to have considerable potential for disease control. Their inhibitory effects against starter cultures in use in Australia are being investigated.

Other Services.—Several cases of microbiological deterioration in canned foodstuffs were investigated on behalf of commercial firms. Sweet corn, dill pickles, chili preserves and relishes were involved.

Bacteriological aspects of dairy products quality control were subject of several addresses to Departmental field officers and industry personnel. A research paper on bacteriophage—antibiotic interactions was presented to the Australian Dairy Manufacturing Research Seminar.

An officer of the Bacteriology Section served on the Executive Committee of the Australian Society of Dairy Technology, led the N.S.W. delegation to the Federal Council meeting of this body, and acted as convenor of three national committees—education, mastitis and bacteriological standards. Lectures and demonstrations in biology and micro-biology were given, for the Technical College, to dairy industry apprentices at a residential School.

Soil Bacteriology

Testing Commercial Legume Inoculants.—Two surveys of the quality of legume inoculants as purchased by farmers were conducted. The first survey of 235 cultures comprised clover, lucerne and pea groups. It showed that the standard of the cultures had fallen when compared with previous years. About 11 per cent were of doubtful quality and 4 per cent unsatisfactory. The remainder were satisfactory or highly satisfactory. The second survey was restricted to cultures of the cowpea type; 30 cultures were tested; 23 per cent were satisfactory.

Laboratory observations indicated that the peat used as the carrier in these cultures was of inferior quality. Investigations were commenced to determine the factors affecting growth and survival in peat. A visit to South Australia showed that the deposits from which the peat is collected comprise peats of four different origins.

Also, samples from each batch of culture from all manufacturers were tested this year prior to release for sale. This aspect of quality control had previously been handled by the University of Sydney, but this year was on a joint basis. In all, 482 cultures representing clover, lucerne, cowpea, pea and vetch, soybean, *Lotus, Leucaena, Desmodium* and *Centrosema* groups were tested.

Field Testing Strains of Rhizobium.—The field tests mentioned in last year's report were harvested in July and the information was pooled with that obtained by the University of Sydney. Three new strains for lupin appeared promising and warrant further testing. No field trials were sown this year.

New Laboratory Facilities.—The manufacturers of legume inoculants donated £1,200, used to build and equip a temperature-controlled laboratory. It will enable extension of the work on growth and survival of rhizobia in peat culture.

Growth and Survival of Rhizobia in Peat Culture.—This ject was commenced because of the deterioration of inulant quality during the year. The first factor investigated s the effect of heating the peat prior to milling, on subquent survival of clover, lucerne and cowpea strains. Heat- peat at 100 degrees C. caused no deleterious effects. ating at 135 degrees C. caused rapid and severe reduction the number of rhizobia originally added to the cooled peat. is applied to all strains tested.

The influence, if any, of the origin of peat on the survival rhizobia is now under investigation. Four main types of at have been sampled for this purpose from the Mt. ambier area in South Australia.

Testing Vetch Inoculants.—This work was commenced to vise more convenient plant-infection methods for counting *hizobium leguminos-arum* (vetch-pea rhizobia) but has been tended to species of *Rhizobium* appropriate to other large eded legumes. Experiments to test methods developed for unting *Rhizobium* sp. (cowpea rhizobia) and *R. lupini* upin-serradella rhizobia) have now been successfully cometed. Further experimental work has not been planned.

Entomology Branch

PASTURE AND FIELD CROP PESTS

Australian Plague Locust (Chortoicetes terminifera).—An utbreak in the central west was the heaviest since 1953-54. nly a fraction of New South Wales was involved, but the tensity of the outbreak in a few districts was surprising. Not ore than a moderate outbreak had been predicted.

The locust season commenced in September and reached its eak in November and December. Locust bands and swarms ere recorded in a number of districts. Infestation was quite ignificant in several—Forbes, Condobolin and Narrabri—but he main outbreak was confined to the districts of Canonba, ubbo and Molong in the south. Extension of it threatened t Forbes and Condobolin to the south, and Coonamble and oonabarabran to the north. The northern and southern sections were independent. There was no interchange of swarms.

In the southern section heavy and extensive hopper bands ccurred, mainly between the Bogan and Macquarie Rivers. ense adult flights were observed from 17th November, heading mainly east and north-east towards Narromine, until about 3th December when a strong westerly and northerly comonent became evident in the movement of swarms. Egg laying was not observed until late December.

In the northern section, an extensive area supported bands nd scattered nymphal infestation. Dense flights commenced bout 11th November in the usual south-easterly direction towards Baradine and Mount Tenandra. Egg laying was bserved as early as 18th November. Other flights occurred along the Castlereagh River at Curban and Armatree were swarms were crossing and heading east. In December locusts locusts still present in the Coonamble district flew west and north-west towards Coonamble, laying eggs over a wide area. In neither section was there much extension of the area of heavy infestation.

The second locust generation commenced to hatch during December in the northern section, and January in the southern section. However, in the latter area locusts occurred on a very much reduced scale, so much so that no further control measures were required and no infestation of any consequence was recorded after January in that area.

In the northern section the outbreak continued on a greater scale. Extensive and dense bands were recorded in the Coonamble district particularly. First dense flights were observed on 10th February, heading south-east towards Baradine. After an initial burst of flight activity during February, swarms gradually dispersed and scattered over huge areas in March. However, by 9th March, swarms became active in the Wingadee area, drifting slowly south, and west of Coonamble towards Carinda where swarms also moved gradually south. These also tended to become loose and scattered before travelling far, although heavy egg laying occurred in both areas. Loose swarms were also seen during this period west of Armatree and Curban. By 7th April no trace of these swarms could be found although they persisted as scattered individuals for many weeks during a period of very dry weather.

Only from portions of the Coonamble district was any appreciable egg-laying reported during late summer and autumn. Some hatchings, heavy in localised areas, can be expected from these next spring, but there is no indication of a widespread outbreak.

In February a field trial was carried out at Coonamble to test the insecticides, thiocron and dichlorvos, against 3rd and 4th instar hopper bands. The insecticides were applied by a knapsack mister and by a larger mister operated from the back of a truck. Results were compared with those from treating similar bands with lindane at the standard recommended rate of 3½ oz. a.i. per acre.

Assessment of results was complicated by the problems of adequate coverage using misting machines. However, both dichlorvos and thiocron, at 3½ oz. a.i. per acre, gave effective control. Dichlorvos applied at 2 oz. a.i. per acre, in one trial only, gave poor control. Dichlorvos had little residual action, if any, whereas thiocron was slower to kill but remained effective for at least three days. Spray coverage was critical when using dichlorvos and there was no evidence of any special effect from the vapour action.

The 1963 aerial spraying campaign between 18th November and 23rd December was done under the direction of a non-statutory committee comprising representatives from each of seven Pastures Protection Boards—Coonabarabran, Coonamble, Condobolin, Canonba, Molong, Forbes and Dubbo. The campaign was kept under field observation, advice and assistance were given, and an attempt was made to assess its effect and value. This was one of the most costly campaigns, per unit of area treated, ever run in New South Wales.

Of interest, however, was the sharp contrast between the southern and northern sections of heavy infestation. In the former, the second locust generation was virtually non-existent, from the economics viewpoint, whereas in the north the outbreak continued unabated well into March.

This difference can be explained only in terms of control effort applied against the first locust generation. In the south the control effort was intensive and prolonged, and practically no large aggregation of flying locusts escaped treatment at some stage. In the north several large flying swarms were not treated and were responsible for very heavy egg laying. This led to the bulk of the second generation hatchings.

In addition to analysis of past outbreaks, a great deal of field data has been obtained on the recent outbreak, by painstaking tracking and observing of locust concentrations. This has been combined with similar data obtained by C.S.I.R.O. officers in the field and will be subject to full analysis at Canberra. It is the most detailed record available of the progress of a single locust generation.

The analysis may ultimately throw light on such matters as why the prediction equation, previously derived from a study of past outbreaks, greatly underestimated the size of the spring (1963) locust generation in the central west.

Phase measurement studies were continued. Morphological indices being used to examine phase differences are standard measurements of head width, pronotum length, elytron length and femur length. A number of series have been completed although a large back-log of locusts collected in previous seasons remain to be measured. In addition, further series have been collected during the current season. Each series consists of 100 males and 100 females where possible. No analysis will be possible until all series have been measured.

It has been found that the collection method may influence final measurements and it will be necessary to apply appropriate correction factors in some cases. For example, locusts killed with cyanide and stored in a dry condition show differences from those collected and stored in alcohol, due to shrinkage of the latter.

Wingless Grasshopper (Phaulacridium vittatum).—Only a few areas reported infestations reaching pest proportions. In the south the Hume Pastures Protection District reported large populations from October to January, and Urana reported similarly during November and December. A very heavy localised infestation at Trangie in October-November considerably damaged a homestead garden.

In the central tablelands, hatchings commenced at the end of October and in early November. Large populations were observed at Cargo, Lidster, Cudal and Oberon during November and December. By late February the numbers had declined drastically and the grasshoppers were found only in a few localities. This reduction was a direct result of the prolonged dry period in tableland districts during the summer.

An insecticide comparison trial was carried out at Cargo in November. The insecticides thiocron, dimethoate and fenthion were compared at rates ranging from 2 oz. to 6 oz. of active ingredient per acre. Dieldrin was also used as a check, at ½ oz., 1 oz. and 2 oz. rates. Heptachlor granules were included in the trial at rates of 8, 12 and 16 oz. per acre. The insecticides were applied to half acre plots, in a randomised block design with three replications, by portable misting machines, except for the granules which were applied by hand.

Estimation of results was by comparison of pre- and post-treatment samples of the grasshopper population in each plot, made with a scooper sweep net. Further counts were made eight days after treatment, and again five weeks after treatment. A preliminary examination of the results indicates that the three organic phosphates tried will provide control at about 4 oz. active ingredient, and dimethoate may be slightly superior to the others.

Spur-Throated Locust (Austracris guttulosa).—During August, north-western districts including Graman, Tulloona, Moree, Bellata, Narrabri, Edgeroi, Burren Junction and Cryon were surveyed. Only an odd specimen was seen. However, adults were reported in wheat during the harvest, October-November, at Tulloona; nymphs were observed in large numbers on the flood plain of the Namoi River after flooding in summer and damaged a few early sown wheat crops. Later, adults were present over a wide area in the Narrabri Pastures Protection district. A dense concentration of adults, stated to be a swarm, was reported near Croppa Creek on 26th March in Sudan grass and caused some leaf damage. A similar "swarm" concentration was observed near North Star on 27th April in a stand of *Sorghum almum*.

Relatively large numbers had been present in 1962 and considerable numbers of nymphs were reported in February, 1963. Since there appears to be only one generation each year, it seems that the adults did not survive the winter in the area inspected during August and it was thought that numbers could not be sufficient to cause concern for at least a further generation.

It is not known whether the large increase in numbers of a mixed population with the migratory locust (*Locusta migratoria*), reported in the Croppa Creek-North Star area in March-April, was due to heavy and concentrated egg-laying by a relatively few locusts of the previous generation, and movement into the area by adult locusts, or to a relatively large nucleus of parent locusts unnoticed in the previous survey.

During the August survey stem damage to young wheat was observed, similar to that ascribed to locusts in previous years. However, it differed in some ways—the height at which the stem was attacked was variable, small pieces of stem were seen on the ground where chewing had occurred, and crops were much later with only an odd head having emerged (previous damage was confined to a 2-3 week period at the time of flowering).

In August field mice were actually observed causing the stem injury at Tulloona (during the evening) and thus, although mice can cause ragged stem injury, stem lopping, and damage to head and grain, it is highly probable that locusts are responsible for considerable stem injury at the time of flowering in some years. Recent work using locusts caged over wheat at Graman supports this.

Cotton Insects.—An insecticide trial, commenced in the Namoi district in January, was to compare fortnightly spraying with DDT 1 lb. plus endrin 4 oz. a.i. per acre, endosulfan at 10½ oz. a.i. per acre, and carbaryl at 12 oz. a.i. per acre, applied by ground rig equipment.

The first three sprayings, 8th and 22nd January and 5th February, took place but other scheduled sprayings were not possible because of height and density of the foliage and the non-arrival of special cotton spraying equipment. The 5th February spraying was critical because of the very heavy infestation by common bollworm (*Heliothis* sp.) then apparent. The whole area was sprayed with DDT-endrin by aircraft on 26th February, 11th March and 4th April.

Excellent control of *Heliothis* was achieved with the DDT endrin; these plots yielded at the rate of 2,347 lb. seed cotton per acre at the first pick on 5th May. Control in the endosulfan plots was not quite as good but the yield at the rate of 2,027 lb. seed cotton per acre was very satisfactory. The first-pick yield in the carbaryl plots at the rate of 767 lb. seed cotton per acre indicated the poor control of *Heliothis*: more than half of the early-set bolls had been lost. Shedding of the early-set bolls in the untreated plots through *Heliothis* attack was practically 100 per cent; yield was at the rate of only 76 lb. seed cotton per acre.

After February, the plants in the carbaryl and untreated plots put forth a mass of vegetative growth. Ultimate maturity of these crops had been greatly retarded by failure to control *Heliothis*, as indicated by the very few mature bolls at the first pick on 5th May when the plants were still in dense vegetation. Also, a high proportion of the bolls produced after the *Heliothis* attack would not burst in time for the second pick. The DDT-endrin treated plants were almost fully mature on 5th May and practically all bolls had burst, whilst endosulfan treated plants were slightly behind.

There were indications that the spraying schedule should be determined by *Heliothis* egg counts on growing tips and young leaves, following appearance of moths in the crop, rather than by an arbitrarily fixed schedule.

Rough bollworms (*Earias huegeli*), which gradually built up in the crop from March onwards, were able to cause more damage in the carbaryl-treated and untreated plants as these had many more buds and young bolls on them. Damage by rough bollworm to all fruiting forms amounted to 4.5 per cent in DDT-endrin plots, 12.5 per cent in endosulfan plots, 21.2 per cent in carbaryl plots and 20.7 per cent in the untreated. This stressed further the importance of early control of *Heliothis* as a means to avoid later rough bollworm damage.

Generally, growers have been satisfied with the results of the recommended DDT-endrin schedules this season.

In Riverina crops, especially in the M.I.A., rough bollworm larvae caused considerable damage from late February onwards where adequate control measures were not taken. The common bollworm seriously damaged cotton flowers and young bolls in Riverina crops in late January/early February, during the main flowering. Peak activity was during weeks of high temperatures which induced rapid plant growth and reduced the life and area of the protective insecticide film. A rigorous DDT spray schedule was required.

In a grower trial at Widgelli, carbaryl, ½ lb. active ingredient per acre, failed to give satisfactory control of a severe common bollworm infestation, but carbaryl at 1 lb. active ingredient per acre gave results close to, but inferior to, DDT 1 lb. plus endrin 4 oz. active ingredient per acre.

A comprehensive list of all insect species collected in cotton crops since the cotton insect pest investigations were begun, together with notes on abundance, habits, damage if any, etc., has been compiled.

Red Legged Earth Mite (Penthaleus major *and* Halotydeus destructor).—Mite infestations were only moderate when cold wet conditions followed the main *H. destructor* hatchings in May, 1963 in southern and south-western districts. However, pasture and lucerne stands sown into infested ground were attacked during the spring and some had to be re-sown.

Damage by *P. major*, more northerly, was of little account.

In the two replicated spray trials, to find alternatives to DDT because of the residue problem, at Wagga against *H. destructor* and at Scone against *P. major*, two treatments gave effective control for six weeks. These were azinphos ethyl and imidan each at ½ oz. a.i./acre and have now been recommended to landholders.

For treatment of new lucerne and pasture stands, where the residue hazard does not matter, DDT at 4 oz. a.i. per acre is still recommended.

Treatment of seed with various systemic insecticides, phorate, thiodemeton, dimethoate and menazon, to protect the seedlings from mite damage during the establishment period was tried on a field scale at Wagga. Lucerne and sub-clover seed were treated and over-sown into a young oat crop heavily infested with *Halotydeus destructor*. The treatments appeared after six weeks to have been unsuccessful. The seed had been mixed with superphosphate shortly after treatment with the insecticide, and sown through the fertilizer box of a combine rather than sown separately through a special pasture seeding attachment.

White-Fringed Weevil (Graphognathus leucoloma).—No useful date have been gathered from four demonstrations in the Manning River district, because infestation has been practically nil. The treatments involved mixing insecticide with fertilizer, applied at the sowing of lucerne and pasture.

In a Cowra experiment, started in 1959, to determine the effect of a pre-sowing treatment with 1½ lb. a.i. dieldrin per acre on infestation of a lucerne stand, larval populations in untreated areas have declined considerably since September, 1962. Thus, whether the dieldrin treatment was still exerting an effect in this the fourth year after treatment could not be assessed. However, protection for at least three seasons has been demonstrated. Untreated check areas have carried populations of at least 2.5 grubs per square for at least two years and quite heavy root damage has been general in such areas.

During September, 1963, another series of observations was made in a lucerne paddock at Canowindra. Portion of this paddock had been treated with 0.9 lb. a.i. dieldrin per acre, and portion with 2 lb. a.i. dieldrin per acre, prior to sowing to lucerne in late April, 1961. The remainder of the paddock was left untreated.

Observations on the untreated area had indicated that lults will not lay eggs into an area which, while they are nerging, feeding and ovipositing is bare of host plants. In e 1962 season considerable infestation was found around e periphery of the area, with virtually no infestation in the ntral portion, indicating re-infestation from the margins of e area.

In the next season it was found in September, 1963, that festation was distributed fairly evenly through the area. o infestation was found in either of the dieldrin-treated eas and dieldrin at both levels has given excellent control er a period of two seasons. In the untreated area severe ot damage to a large proportion of plants was apparant hereas there was no root damage in treated areas. These oservations demonstrate the value of pre-sowing, dieldrin eatments under such conditions.

In October at a property near Forbes larval counts were ade in an area treated with dieldrin 1 lb. a.i. per acre in anuary, 1963. The dieldrin had been applied in irrigation ater. The grower has so treated large areas of his property, aving devised a method of accurately metering the insecticide to the irrigation water. Dieldrin had reduced the larval opulation to a very low level.

Clover Root Weevil (Amnemus *spp.*).—Investigations ere continued in co-operation with the University of Sydney. lethods of application of different formulations of dieldrin establish clover pastures were examined, because of dieldrin residues in the milk and body fat of cattle grazed on astures treated with emulsion and dust formulations. Diainon was also tested.

Amnemus control was very satisfactory with surface appliations of emulsion and granules of dieldrin, and with sub-urface granule applications. Diazinon granules were ineffecve.

In another experiment the dieldrin residues on pasture tops ere determined at intervals after surface and sub-surface pplications of dieldrin granules and surface applications of ust and emulsion. All residues were low. The highest itial residues occurred with surface applications of emulsion, ust, and granules, in that order. The lowest occurred with e sub-surface granule application. Two weeks after applicaon no residue could be detected with the latter, nor with the urface granule application.

Whilst nil residues were demonstrated on treated pastures, e position could be very different in common practice—ffected by stock withholding periods and by less than exact dherence to recommended practices. Therefore, all recomnendations involving surface application of dieldrin and reated compounds to pastures or fodder crops have been ithdrawn.

A long term experiment continued at Wollongbar, co-operaive with Division of Plant Industry, to determine by approriate grazing whether insecticidal control of *Amnemus* is ecessary in subterranean clover pastures. In this second ear of the experiment, larval counts suggested that heavy razing in January and February obviates the need to use nsecticides against *Amnemus* in subterranean clover.

Black Beetle (Heteronychus sanctae-helenae).—Black beetle as caused very little damage since 1957.

Two adult beetles were recorded at Leeton this year, so his beetle has now been reported from three inland towns: lbury, Leeton and Dubbo.

First reported at Albury in March, 1962, emergences were gain noted in August, September and October, 1963, and amage to lawns and a district potato crop were reported in anuary, 1964. Heptachlor at 1 lb. a.i. per acre in December ave a good kill within two days.

Lucerne Flea (Smynthurus viridis).—This was less troubleome in the Albury district in September than during the revious autumn, but was more prevalent than usual at Tumut. t was in a 3-year-old stand of lucerne and sub-clover near riffith in early May, badly damaging about 12 of 80 acres, ut neighbouring lucerne—sub-clover stands were not infested. nly one previous Murrumbidgee Irrigation Area instance is nown. This also was at Griffith, in 1945, and had disappeared y 1947. Specimens in lucerne came from Wellington in arly June, 1964. This is the first record from this district.

Pest Survey of Tropical Pasture Legumes.—The promising tropical summer legumes *Glycine javanica, Desmodium uncinatum, Desmodium intortum,* Siratro, *Lotononis bainesii* and *Dolichos lab lab* are now sown in many parts of the North Coast Region, so this year a survey to determine the insects occurring on these plants and their relative importance was begun.

Seedling tropical legumes are attacked by many insects and the following are potentially serious pests: *Amnemus quadrituberculatus* (clover root weevil), *Graphognathus leucoloma* (white-fringed weevil), *Agrotis* sp. and *Prodenia litura* (cutworms), *Halticidae* (flea beetles), *Malanagromyza phaseoli* (bean fly) and *Noctuidae* (semi-loopers). An unusual pest of a seedling stand of *G. javanica* was *Rhopaea magnicornis,* normally thought of as a pest of grassland. Six acres of *G. javanica* sown into a clean seed-bed with green panic was completely destroyed by *Rhopaea*. The larvae severed the young plants' tap roots.

Established tropical legumes usually grow prolifically, have strong root systems, and have not been severely affected by insect infestation.

Heliothis spp., *Nezara viridula smaragdula* (green vegetable bug) and *Riptortus* sp. (pod-sucking bug), are common pests of Siratro, *Desmodium* and *Glycine* seed crops.

Slugs (Agriolimax sp.).—In autumn and winter slugs are important pests of north coast clover pastures. In seedling clover sown in clean seedbeds, bran or pollard baits incorporating metaldehyde or metaldehyde and BHC have proved effective. Effective control materials are needed for use in established clover and in over-sown seedling clover.

Copper oxychloride (50 per cent Cu) and metaldehyde (20 per cent w.p.) were tested at Byrrill Creek, Tweed River, at rates of 1, 2 and 4 lb. per acre in established ladino clover two to six inches high. Boom spraying equipment was used mounted nine to twelve inches above the ground. Rate was 12 gallons per acre. Results, with all materials, were unsatisfactory. Significant reductions occurred for a few days, then slug numbers rapidly increased to pre-treatment levels.

Baits containing pollard, BHC and metaldehyde, pollard and metaldehyde, and metaldehyde pellets were assessed in oversown seedling clover in plots 30 x 30 ft. None proved satisfactory.

Bloodworms in Rice (Chironomus sp.).—Rice seed dusted with DDT at 2 oz. a.i. per 100 lb. of seed was supplied to several growers who each sowed a bag of seed alongside untreated seed within the same bay in orthodox seed beds. Good protection from bloodworm infestation was obtained. The yield increases ranged from 40 per cent to 100 per cent.

Armyworms and Cutworms (Noctuidae).—Cutworms and armyworm outbreaks were reported from several districts, coastal and inland. The worst plague for many years in the Albury district occurred during the months of August to December affecting pastures, oats, wheat, barley, linseed, cowpeas, lucerne, sweet corn, maize and sorghum. The oat crops were severely damaged. DDT gave good control.

Life history studies on the tobacco cluster-grub *Prodenia litura* were commenced. Larvae collected at Windsor were bred through to adults to ensure absence of disease and parasites. Eggs were laid at night in batches of 50-400, and hatching 3-4 days later. The larval stage, about 21 days, was followed by a pre-pupal stage of 24-36 hours. The pupal stage occupied 12-16 days. Mated moths began laying 2-3 days after mating. Total period for one generation in the laboratory was 6-7 weeks.

Wireworms (Conoderus sp.).—The effectiveness of disyston 1 lb. per acre, heptachlor 1½ lb. per acre, and dieldrin ¼ lb., ½ lb., 1½ lb. and 2 lb. per acre, applied in mixture with superphosphate at the sowing of maize were compared at Furracabad in October. Neither the disyston nor heptachlor treatment was as good as any of the dieldrin treatments. Rates of dieldrin in excess of 1 lb. per acre made no appreciable difference, but effectiveness increased with rates up to 1 lb. Suggestion of suppression of maize plant emergence occurred with the heptachlor treatment.

Pasture Scarab (Aphodius tasmaniae).—Conditions favoured pasture growth in the central and western tablelands, southwestern slopes and Riverina districts during the winter. Feed was plentiful and landholders generally were not greatly concerned by the pest. Results were good where BHC treatments were used. Infestations were generally light. Few reports of damage were received.

Black Soil Scarab (Othnonius batesii).—Analysis of samplings of 15 separate populations in the Graman area during the period May, 1959, to May, 1964, has indicated a marked rise in most populations sampled since May, 1963; 12 populations have increased in this year and three have remained level.

Since sampling commenced in 1959, eight populations have increased, three have remained level, and four have decreased. It was reported last year that there had been a reduction (in the 1962-63 season) in most of the populations being sampled. Whilst this was so in May, 1963, further sampling during the remainder of 1963 showed the marked increase.

Each increase has been due to a delayed hatching and/or emergence of first instar larvae from the egg "pods". As the last beetle flight occurred during the period from 2nd to 5th January, 1963, and egg-laying would have been completed by mid-January, the delay in hatching and/or emergence for a period of five-six months is phenomenal and indicates a good survival mechanism.

The adult flight season lasted from 28th November, 1963, to 24th February, 1964. Four flights occurred, but they were generally light—as would be expected from the figures obtained by sampling populations during 1963.

Extensive observations on larval food plant preferences have been collected and experimental work is now in progress to test feeding preferences in pasture grasses and crop plants. In one trial conducted, *Phalaris tuberosa* showed significantly greater resistance to larval attack than three strains of *P. arundinacea* ($p = 0.001$).

New areas of infestations recorded since 1962 are: the Cryon-Thalaba-Burren Junction area, where damage areas of up to 400-500 acres in extent were noted; Tulloona Bore; and the Narrabri-Wee Waa-Bellata area. Slight damage was noted in wheat crops in the Tulloona Bore area.

From observations in 1960 and in 1964 in Macquarie Region, it is apparent that soil type can be correlated with the extent and distribution of *Othnonius* infestations. Infestations were far more extensive on black earths mapped by Downes and Sleeman (1955) as Cooledah black earths belonging to the Cooledah soil association and Garrucca black earths belonging to the Garrucca soil association. The very light infestations at Mullaley and Tambar Springs were on Goorally black earths (Goorally soil association).

Eleven more control trials were established this year. Continuing observations on previous trials show that surface application of 8 lb. DDT and a subsurface ("sown") application of 4 lb. DDT per acre are still exerting a controlling influence on grub numbers, respectively seven and six years after application. In the pasture-insecticide trial established in June, 1958, the DDT 4 lb. per acre plots are outstanding. Even after heavy continuous grazing, a good basal cover of native grasses is evident—resulting in little or no mintweed intrusion. Outside the DDT plots the condition is reversed, mintweed being dominant.

Pruinose and Related Scarabs (Sericesthis pruinose *and* Rhopaea *spp.*).—Four Bega localities, Candelo, Merimbula, Wallagoot Lake and Wapengo, were inspected in November to investigate the problem of *S. pruinosa* in improved pastures. The pastures are mainly cocksfoot/ryegrass/white and/or red clover or ryegrass/white and/or red clover, but one at Candelo included some *Phalaris tuberosa.*

Most of the pastures had been badly damaged in the previous autumn by *S. pruinosa* larvae. They had recovered to a great extent by November, 1963. Ryegrass seedlings occupied the place of dead plants. The light *P. tuberosa* pasture at Candelo was interesting because it was reported that of the grasses (ryegrass and cocksfoot mainly) in the pasture all but *P. tuberosa* had been killed out. Inspection showed larvae under *P. tuberosa* plants, but little damage.

In a trial of whether annual application of dieldrin 1 lb. a.i./acre to red clover pasture during December-January will help to maintain red clover in the pasture over a period of years, one half of a two acre area of red clover pasture was sprayed with dieldrin early in January, 1963. The other half was left unsprayed.

In late spring/early summer of 1963, the dieldrin-treated area was being badly damaged underground by grass grub larvae (*Oncopera* sp.). At least 60 per cent of the pasture in the treated area was destroyed by the *Oncopera* larvae, whilst the untreated area suffered little or no damage.

Native Budworm (Heliothis punctigera).—In this year of moderate *Heliothis* infestation of linseed, four insecticide control trials were laid down. The larval counts showed that DDT is still the best insecticide available. Endosulfan and carbaryl, at 1 lb. a.i./acre showed promise as alternatives.

DDT or endosulfan, 0.2 lb. a.i./acre applied weekly for three weeks, gave outstanding control of *Heliothis.* Such treatment could well be utilised when prolonged hatching of eggs occurs.

Soybean Fly (Melanagromyza sojae).—In late June, 1963, substantial areas of smooth Darling pea (*Swainsona galegifolia*) dying on a Graman property were found to have been damaged by a small fly. The larvae bored into the stems, and conductive tissues were destroyed. This damage to Darling pea was first noticed in the same area at Graman in December, 1960.

The fly has been bred out and identified as soybean fly *Melanagromyza sojae.* This is the first Australian record of the insect. It is a widespread pest of soybeans overseas.

M. sojae has been found infesting Darling pea on many properties in the Graman area and been recorded also at Inverell, Gum Flat, Little Plain, Oakwood, Warialda, Delungra, Myall Creek, Attunga, Mungindi, Willow Tree, Mullaley, Currabubulla, and 22 miles south west of Coonabarabran.

FRUIT TREE PESTS

Red Spider (Tetranychus *spp.*).—Overwintering observations at Orange, on migration of red spider (*Tetranychus telarius*) to and from ground cover and the effects of winter clean-up measures, were commenced in August. The great majority of spiders were then under suitable shelter in the tree crotches and elsewhere, but many were feeding on ground cover up to 10 feet away though more numerous near the trees.

Subterranean clover was by far the preferred host. Development of the pest on this was much more rapid and prolific than on other plants. The only other host of importance in the area was red-flowered mallow (*Modiola caroliniana*). This, although not a really suitable host, is widespread from late winter to mid-summer. Spiders on the ground cover in August and September did not return to the trees, but at low temperatures (about 50° F. and below), simply remained inactive on the host plant. They resumed activity when temperatures rose sufficiently. If suitable weed hosts were adjacent to trees many spiders migrated to these in early spring; if not, they remained in shelter on the tree, emerging and crawling about during periods of warm sunshine, apparently not feeding until the young apple leaves appeared in early October. If very suitable hosts such as sub-clover were present, spiders fed actively on them from early September, laid eggs and changed colour. Egg hatching was observed as early as the second week in September on sub-clover.

Normal activity by summer forms of the pest can occur a good deal earlier than previously imagined. By late September the first summer generation are almost adult on sub-clover, whereas many of the winter forms are still present on trees quite late in October.

Winter clean-up measures were investigated, including clearing of overwintering spiders and trash out of the tree crotches, removal of loose bark scales, and the dormant oil spraying of trees so cleaned. No evidence that such measures significantly delayed summer build up of the pest was secured.

Banding the tree trunks with a sticky material in late winter very considerably delayed spider build up in early summer. It appeared that, probably during September, all spiders moved downwards and became entangled on the bands.

This year considerable trouble was experienced by growers in the M.I.A. in preventing the increase of red spider mites (*Tetranychus telarius*) and their damage on pome and stone fruits during the hot dry summer in late December, January and early February. Pears particularly were badly damaged. Where dicofol (kelthane) or tetradifon was applied thoroughly in late November, and followed within three weeks by a second application, the mites were held in check.

During severe heatwave conditions and with an expanding population of red spider mites, several new materials were evaluated. Of these, none was better than 0.03 per cent carbophenothion; but one product, chloropylate, gave very good immediate results. Milbex and micasin also gave very good control when taken over a period of four weeks.

Dicofol is the most widely used of the several miticides recommended for the control of red spider (*T. lambi*) infesting banana foliage on the north coast. Recommendations include a high volume rate of application and a low volume misting rate of 10 fl. oz. 15 per cent dicofol e.c. per 2 gallons of water. The practice of misting fruit with dicofol at that rate has become widespread, as a precaution against red spider infestation before plastic bunch covers are applied in autumn.

Following reports of fruit burn, the effects of dicofol misting on fruit were investigated in the Tweed district. At 10 fl. oz. 15 per cent e.c. per 2 gallons of water, dicofol caused very severe burning, especially where the diluted emulsion coalesced into droplets on the bottoms of the fruit. Injury was more severe on young fruit than old, but occurred on both. At the rate of 4 fl. oz. e.c. per 2 gallons of water, burning also occurred and was more severe with some formulations than others. Both young and old fruit were injured, but the blemish on older fruit was minor. High volume application of 0.05 per cent dicofol e.c., to bunches at all stages of maturity, caused no burning of fruit. This suggested that dicofol may be used in this way safely on fruit, but not by semi-concentrate misting.

Further samples of red spider suspected of resistance to ofol were received from the Orange district. Bio-assay tests owed that some tolerance had developed in these strains, but e resistance was not established.

Identifications by Professor Boudreaux of Louisiana State niversity, U.S.A., confirmed that the green and red feeding rms are two distinct species. The red form is *Tetranychus deni* (Zacher) and the green is *Tetraychus telarius* (L.). *telarius* and *T. ludeni* have been recorded from both tablend and coastal areas, but records indicate that *T. telarius* edominates on the tablelands and *T. ludeni* in coastal areas.

Overwintering females of a strain of *T. telarius* collected at ange during May, 1963, were stored in this phase in a frigerated room at 40° F. The mites remained alive and produced normally until the first week in May, 1964.

In bio-assay tests using adult female mites, chlorpropylate ve a good initial kill, but had no residual properties; milbex as very good; micasin was not effective; and bidrin gave od initial and residual kill.

European Red Mite (Panonychus ulmi).—Twenty orchards Orange, four at Bathurst and four at Molong were inspected winter for presence of European red mite. Eggs were found two orchards at Orange, one at Bathurst and one at Molong irst record); but there were few, and very restricted in cidence. *Bryobia* mite eggs were far more plentiful and idespread; mostly on plums and cherries, with very few on ome fruits.

No trace of European red mite was found in several rchards where it had been recorded previously. It is obviously idespread in New South Wales, although of extremely light ccurrence. Conditions are apparently so unsuitable that it as never assumed any importance and is of secondary significance compared with Bryobia mite.

Woolly Apple Aphid (Eriosoma lanigerum).—Observations ere made on apple trees which had been sprayed with amidothion in the previous season (1962-63) and for that eason had remained completely free from aerial infestations f the pest.

In one block, at Spring Terrace, all trees were showing very ight aerial infestation in late spring. This infestation remained ight until February, when all trees became sufficiently inested to require some treatment. In the other block, at innacle Road, infestation was considerably lighter and almost one appeared until well into February. However, eight out f nine trees showed infestation. Five of these showed sufficient infestation in late February and March to require some reatment.

Thorough treatment with vamidothion, seemingly gives omplete control for one season but cannot be depended upon o do so for a full second season.

Codling Moth (Cydia pomonella).—No experimental work was done on this in 1963-64.. Growers continue to obtain xcellent control in apples and pears by using a programme of sprays based on either azinphos or carbaryl.

Oriental Fruit Moth (Cydia molesta).—Damage to canning peaches in the M.I.A. by this moth was at its lowest for ears, due mainly to the very dry, hot summer affecting the pest. Most peach crops ripening after December escaped damage, even where the standard spray material azinphos and arbaryl were not used.

Canning peaches did suffer considerable damage in the pring from a looper caterpillar damaging the recently-set fruit. Satisfactory control was obtained with carbaryl and azinphos where applied before the damage became marked—mainly about petal-fall. Throughout the M.I.A. about 20 per cent of the crop was badly marked by this looper caterpillar.

Light Brown Apple Moth (Epiphyas postvittana).—Trap records revealed that light brown apple moths were especially active in November-December in the M.I.A. and some activity was again noted in the autumn. Carbaryl and azinphos controlled this pest satisfactorily when applied in regular spray schedules for pests of peaches or pome fruits.

Trials in the early summer on apples showed that dichlorvos and mevinphos were useful in immediate knockdown of larvae webbing apple leaves; much more so than fenthion, carbaryl or dimethoate, but the residual value was negligible.

Apple Root Weevil (Perperus *sp.*).—Investigations into the problm of dieback and unthriftiness of apple trees in the Batlow district were commenced in August. An area infested by the apple root weevil was planted with young trees in an attempt to establish whether root infestation by the weevil *Perperus* sp. does in fact adversely affect growth. Portion of the area was old apple land, while portion was land which had grown apples until 1955 but thereafter had been under grass. The intentions in this experiment are to have half the area heavily infested by weevils, to maintain the other half free from weevil infestation, and to compare the treated and untreated areas for growth rates and root damage.

Half the area was treated with dieldrin 5 lb. a.i./acre before planting, and was surface-sprayed with dieldrin in early November to eliminate weevils which had emerged. The untreated area was on the other hand artificially infested, as by placing larvae in the planting holes and by liberating weevils adjacent to the trees. It was subsequently apparent that the pest was well-established in the area. Therefore artificial augmentation of the population ceased.

At planting, trunk diameter measurements were made of all trees in the experiment. These measurements will be made each year, to demonstrate growth rate differences between infested and uninfested blocks.

Emergence of adults commenced in late September and continued until about the second week in November. The peak was in the first half of October. Adults were mostly found feeding voraciously on lamb's tongue (*Plantago lanceolata*). They also fed freely on sorrel, subterranean clover, blackberry and young apple and pear trees. Few weevils ascended mature apple trees. It seemed neither necessary nor important for them to do so.

Extensive egg-laying which probably commenced in mid-October, was observed in late October, on leaves of young apple trees, on blackberry, and especially on sub-clover. Eggs were not found on the favoured food plant, lamb's tongue, nor on mature apple trees.

Egg-hatching occurred in about a fortnight in the laboratory. So, although no evidence of hatching was seen in the field at the end of October, field hatching probably commenced in very early November.

No further emergence of adults was observed after about the second week of November, though weevils were quite numerous in early December, 1962. Emergenec of adult weevils was observed in areas which had not been under apples for many years, and it was confirmed that the pest could exist in the larval stage independently of apple roots. Newly emerged adults were observed in the soil in mid-May, some at depths up to 2 ft. It is known that adults can appear in the soil some weeks before they emerge at the surface, but their presence in May was puzzling.

Green Peach Aphid (Myzus persicae).—In trials, vamidothion, fenitrothion, mevinphos and phosphamidon each adequately controlled green peach aphid. Growers in the M.I.A. have obtained satisfactory control with available systemics and with malathion where thoroughly applied.

Mealybugs (Pseudococcus sp.).—Some success was obtained against grapevine mealybugs with ethion-in-oil as a late-dormant spray. Out of twenty vines sprayed in each of several treatments, only one tree in the ethion-in-oil treatment was infested with one or more mealybugs in early December, four in the carbaryl plus dormant oil, six in the untreated, nine in the trithion-in-oil and nine in the dormant oil alone.

Banana Beetle Borer (Cosmopolites sordidus).—An experiment, begun at Tomewin in 1963 was continued, to assess the insecticides heptachlor and fenchlorphos under plantation conditions. Treatments were: heptachlor ½ and 1 lb. a.i./acre (emulsifiable concentrate formulations); heptachlor 1 lb. a.i./acre as a dust in fertilizer; dieldrin emulsifiable concentrate ½ lb. a.i./ acre; and fenchlorphos emulsifiable concentrate 1 lb. a.i./acre.

Assessment of weevil borer made fifteen months after application indicated that fenchlorphos was ineffective but that the three heptachlor treatments were giving very satisfactory control, comparable with the at present recommended dieldrin treatment.

Macadamia Leaf Miner (Acrocercops chionosema).—The larvae mine and destroy much of the effective leaf surface. Laboratory rearing of the insect was done this year.

Eggs are deposited singly on the epidermis. The young larvae mine the leaves, etching irregular tunnels just below the surface. The tunnels, usually more than 1 inch long, end in large blisters formed by separation of epidermis from the leaf tissue. Often more than one tunnel leads into the blister. Older larvae feed within the blisters.

There appear to be three instars occurring in the mines and three in the blisters. Early instars are legless and apparently have mouthparts adapted for sucking. Later instars have well developed legs and mandibulate mouthparts. Larvae are white to cream, but in the final instar turn pink. Larval stage occupies 7-10 days.

Pupation occurs externally on the foliage. The pupa, tan in colour, is covered and obscured by a flat white film about ½ in. in diameter. Pupal stage occupies 11-16 days.

The adult moth is about ⅛ in. long and has transverse brown and white stripes on the wings. Eggs are only deposited on very young soft leaves. Consequently larval mining and leaf injury occur only on young foliage and most of the damage is done in spring and early summer—corresponding with new growth on trees.

An insecticidal screening experiment was conducted at Duranbah. Axinphos ethyl, endosulfan, telodrin, fenthion and endrin were tested. Potted seedling macadamias were dipped in diluted emulsions and placed under miner-infested trees. Azinphos ethyl 0.05 per cent and telodrin 0.1 per cent were the most effective. These protected foliage for 16-17 days.

Red-shouldered Leaf Beetle (Monolepta australis).—A laboratory, life cycle study was initiated. Beetles taken from swarms were held in cages containing potted maize seedlings. The eggs, laid singly or in groups in the soil, are fawn coloured, delicately reticulated and oval. Hatching occurred at about three weeks in spring.

The first instar larvae are white to cream. They have well developed legs and prominent black anal plates. The larvae have a marked tendency to wander and could not be induced to feed. All efforts to rear them failed.

Adult beetles are apparently fertilized before or during swarm flights. The individuals taken from swarms were gravid, and oviposition occurred in about two days. Females predominate in swarms, by as much as ten to one. Males may be distinguished by structure of the terminal abdominal segment wherein the ventral surface is deeply notched on either side. In the female the surface is plain.

San Jose Scale (Quadraspidiotus perniciosus).—Dormant oil sprays applied alone or with one of the organic phosphates gave very good control. In the M.I.A., weather and wet soil prevented many growers from applying these sprays. Consequently several of the combinations of growing-season oils with either carbaryl, ethion, malathion or trithion were used successfully on peaches, apples and pears in the spring. These sprays were developed for post-harvest autumn applications. Spray injury symptoms were reported where they were used in mid-summer, mainly because of the oil components.

Frosted Scale (*Eulecanium pruinosum*).—In heavy, spring infestations of fruits by the prune or frosted scale, 0.1 per cent malathion plus white oil 1 in 100 gave very satisfactory control. Malathion 0.1 per cent without oil did not control the infestation sufficiently nor stop copious production of honeydew which contaminated the fruit. Carbaryl 0.1 per cent plus white oil 1 in 100 also gave excellent control.

White Wax Scale (Ceroplastes destructor).—The standard control recommendation on the central coast is white oil 1/40 or 1/50 applied at full emergence of the larvae. Some combinations of white oil 1/100 plus organic phosphate (malathion, dimethoate, ethion) applied at the same time are more effective, but not sufficiently to justify their extra cost.

Carbaryl plus white oil 1/100 gives outstanding control of white wax scale, when applied at the usual timing, and 0.05 per cent w.p. has appeared to be sufficient in the combination. It is unlikely to replace white oil 1/50 as the standard spray for white wax scale as it is not sufficiently effective against red and purple scales and not compatible with Bordeaux mixture. It could have a place for specific use against heavy white wax scale infestations.

Red Scale (Aonidiella aurantii).—Red scale reached major proportions this year in the M.I.A., in the very hot, dry summer.

The 1962-63 spraying experiment at Yanco, which ended in November, 1963, demonstrated very good results from two-spray (December, 1962, and February, 1963) programmes. Best of the February variants were ethion-in-oil with dimethoate plus white oil; a repetition of the 1961-62 observations.

Citrus Rust Thrips (Chaetanaphothrips orchidii).—This thrips appears to be identical with a banana rust thrips (*Scirtothrips signipennis*). It blemishes the stem ends of oranges, presumably through infestation at or soon after blossoming. Valencia trees at Jilliby were October sprayed with dispersible sulphur in Bordeaux mixture in a trial to prevent this stem end injury.

No banana rust thrips were seen either on the untreated or the sulphur sprayed trees, from before blossoming until early December. Then several adults were taken under the sepals of new green fruits, and this suggests that the stem end blemishing may be done in December rather than near blossoming.

The main blemishing, which occurs on the sides of the fruit in the summer—autumn when the green fruits are touching each other, is prevented by spraying with 0.025 per cent dieldrin when the fruits begin to touch each other early in February.

Citrus Gall Wasp (Eurytoma fellis).—Citrus gall wasp parasites bred from galls collected on the north coast had been released in parts of the Sydney metropolitan area in 1957. Citrus twigs damaged by gall wasp were collected in the spring of 1963, from an area bounded by North Turramurra, Brookvale, Cronulla and Menai, to assess the establishment and distribution of parasites. From the material collected at Brookvale, the following parasites emerged—two adult *Epimegastigmus trisulcus,* one adult *Epjibootania nonvitta* and several *Epimegastigmus brevivalvus. E. brevivalvus* emerged in varying numbers from the galls collected in most of the other suburbs, including Cronulla and Menai—the southernmost points of the survey.

In an experiment on the effect of high temperatures on gall wasp emergence, nursery citrus trees and an older tree's wood were immersed in hot water at 110°, 115° and 118° ± 1°F. for periods of 15, 20, 25 and 30 minutes. Only the above ground parts of the trees and uncut surfaces of the branches were immersed in the hot water. When removed from it, they were immediately plunged into cold water for five minutes then allowed to drain. The following day the trees were replanted and covered with gauze and the branches placed into cages. Results were assessed by counting the emergence holes. A temperature of 115°F. for 30 minutes appears to be the minimum necessary to prevent emergence of adult wasps.

Queensland Fruit Fly (Dacus (S.) tryoni).—Following a spring and early summer period in which widespread rains provided State-wide conditions accepted as conducive to fruit fly, activity has been of low order generally. A few exceptions were town areas on the central coast. Some more generalised infestations were reported from the north coast and the north-west. Fruit production was relatively fly-free where prophylactic and therapeutic baits or sprays were used.

In the Sydney area, following low incidence of fruit fly attack during 1962-63, a heavy second crop of apples and other fruits remained significantly uninfested by fruit fly into the 1963 winter. During September, stinging of passion fruit was noted at Murwillumbah, as was some further general activity in October. Severe infestation of loquats was found in Quirindi in October, but not in other areas. Some light fruit fly activity occurred in the Sydney area in October and in January, when most of the stone fruits had finished and this had resulted in very little loss due to fruit fly.

Some fruit fly infestation, especially in mangoes, was reported at Murwillumbah in January, as was maggot development in a particular passionfruit hybrid (*Passiflora edulis* × *P. edulis var. avicarpa*). From the same area in the autumn there was an unusual infestation in avocados consigned to Adelaide; attributed to combination of a varietal susceptibility and an unusually large April brood of fruit flies.

On the central-western slopes, Forbes was free from the pest until March, when light infestation was recorded, and Parkes was free until May.

During April in the Sydney and Murwillumbah areas, more normal and some heavy infestations developed at the end of the fruit season. Late pome fruits and navel oranges on the central coast and navel oranges and avocados on the north coast were infested. At Richmond, where population counts were made, the peak catches of the whole season occurred in April.

In the third season (19623-63) of the Richmond-Windsor town treatment trial, fruit fly infestations in Richmond built up to relatively high proportions by April, 1963 but were some 30 per cent. less than in Windsor. In late November, there was some 50 per cent. less infestation in Richmond than in Windsor, seemingly due to the reduction of over-wintering female flies by the treatment in Richmond concluded in April, 1963.

Infestation rate of peaches in Windsor remained similar to that of previous years and that of Richmond closely averaged Windsor as it also did in the 1961-62 year. However, male-lure trapping showed decidedly lower than usual numbers of flies in either town until April, when a general fly-wave occurred.

he importance of orchard hygiene and stimulation of apeutic spraying by householders has been indicated in trial; as has the greater effect of food-lure applications en applied in the autumn and again early in the fruit son, at the relatively low dosage rates of the protein rolysate-malathion used in Richmond. In addition, male lures should have a desirable effect, at the low level of age rate employed, particularly when combined with these approaches.

inally, the need to increase dosage rates or in some way end the area of application of the lures and regulatory ivity employed for the purpose has been further under-ed by the work.

rganic phosphate sprays so far used on the susceptible ly peach varieties Clarkes and Watts have been liable to se severe injury to these trees.

n a trial on early peach varieties this year, the ethyl amide ivative of dimethoate proved similar to dimethoate with ard to plant damage. Thiocron gave less acute damage d vamidothion was of distinctly lower phytotoxicity. Di-ovis and naled showed promise, possessing low residual icity and also rating very low in phytotoxicity. The short-m disinfestation would make these chemicals ideal choices special applications, such as in fruit-dipping procedures.

The fruit fly suppression scheme operating in the M.I.A. d nearby towns of Narrandera and Hillston was extended Hay in the winter of 1963, on the initiative of the Hay unicipal Council. Mobile units applied protein yeast hydro-ate-malathion in each area at fortnightly intervals. This atment was supplemented by a grid of non-retaining male-e traps in each locality.

The M.I.A. towns recorded a year free from Queensland uit fly, as also did Hillston. A few infested fruit were und in Hay, but in no other locality in the scheme. In 63/64 only 24 fruit flies were trapped in Hay for the period ly to April compared with 717 for the same months of e previous year. Narrandera, the only other locality record-g fruit fly, trapped only four adults for the entire season d no infested fruit was found.

In January, 1964, New Zealand officially accepted E.D.B. migation for packed oranges as a fruit fly sterilization treat-ent for Australian oranges from fruit-fly affected areas. e only condition attached is that a shipment of treated uit to any one New Zealand port should not exceed 20,000 ses. E.D.B. fumigation of fruit, after packing, is at pre-nt the most convenient method known for fruit sterilization ainst fruit fly. This acceptance by New Zealand completes e investigations on the use of E.D.B. fumigation on oranges.

E.D.B. fumigation studies were continued with lemons, andarins and grapefruit. Three trials showed that Marsh apefruit are generally rather susceptible to rind injury by .D.B. fumigation. Similar trials with Emperor and Beauty Glen Retreat mandarins showed these two varieties to e quite tolerant of E.D.B. fumigation. Results with Eureka mons and Ellendale mandarins were somewhat indeterminate 1963. When the work with lemons was repeated in 1964 me slight sensitivity to E.D.B. fumigation injury was seen.

From January to May, 1963 a co-operative project of old storage (32°F.) sterilization of artificially infested pears arried out at the Citrus Wastage Research Laboratory. The ork was aimed at meeting U.S.A. requirements (*vide* .S.D.A. Circular No. 551—"The basis of treatment of pro-ucts where fruit flies are involved as a condition for entry nto the United States", Baker, 1939).

The results, plotted as probit lines, and with appropriate nalyses, were forwarded to U.S.D.A. quarantine specialists or comment. Their replies suggested that the U.S.D.A. would equire, as well as mortality data expressed as a probit line, ctual demonstration of probit 9 security in experiments.

To meet these experimental standards a further co-operative roject on cold storage sterilization was commenced at the nd of January, using apples as the experimental medium. t first the artificial infestation gave rather low yields of arvae. The sterilization temperature was 33°F. The work s continuing.

Fifty-four samples of boxthorn (*Lycium lorridum*) berries vere received during the year; 37 from Tamworth and the thers from Bathurst, Dubbo, Narromine, Nyngan, Hillston, Howlong Corowa, Albury, Cubbaroo, Caringbah and Rich-nond. A few Queensland fruit fly (*Dacus tryoni*) were bred rom the Tamworth material. Other insects bred were *arpophilus* sp. (Tamworth, Caringbah and Richmond), *catopse fuscipes* (Tamworth and Narromine), *Drosophila nelanogaster* (Tamworth, Narromine and Dubbo), *Drosophila mmigrans* (Tamworth and Narromine). *Lamphrolonchaea rouniana* (Tamworth and Richmond), *Desmonetopa ciliata* (Tamworth), *Fannia canicularis* (Dubbo) and *Opius tryoni* (Tamworth). The large number of the lesser house fly (*Fannia canicularis*) bred from specimens from Dubbo is a new and very interesting record.

STORED PRODUCT PESTS

Wheat Pests.—Under the requirements of the Exports (Grain) Regulations, Departmental inspectors have inspected both ships and wheat for freedom from insect infestation prior to loading. Insect infestation continued to be detected at ports in eastern Russia and mainland China. Other countries expressed satisfaction with shipments of Australian wheat in the same period.

The present position is that ship inspection prior to loading appears quite satisfactory, but insect infestation exists in the wheat at loading.

A survey of insect infestation in wheat entering N.S.W. storages from the 1963-64 harvest was initiated along similar lines to that of the 1961-62 harvest. In all, 711 samples were received from 27 storages. Only eight of the samples contained living insects at the first sieving but, after incubation for 8-10 weeks, infestation had developed in 23 samples. The saw-toothed grain beetle, *Oryzaephilus surinamensis,* was again most common.

Degree of infestation was less than in the 1961-62 survey when 80 of the 735 samples received contained living insects on arrival.

Rice Weevil (Sitophilus oryzae) *in Wheat.*—A grain protectant trial commenced in January, 1961, was sampled finally in October, 1963. Replicated insecticide treatments in 44 gallon drums was the system. Insect populations were slow to build up and the period of the trial was longer than normal storage requirements. Malathion and pyrethrum-piperonyl butoxide each gave excellent protection. Carbaryl also performed well and should be considered further as a grain protectant. Bromoden, a chlorinated hydrocarbon, performed well at 50 p.p.m., except against *Oryzaephilus surinamensis,* but has been withdrawn because of residue difficulties.

In May, 1963, bulk grain fumigation with aluminium phosphide tablets was compared with malathion spray treatment. Post-treatment samples were sieved, held for six weeks at 25°C and re-examined. The results showed 100 per cent kill in all treatments, both at the initial examination and after incubation. *Rhyzopertha dominica* and *Tribolium* spp. were the dominant species present.

Lesser Grain Borer (Rhyzopertha dominica).—Laboratory trials have tested the relative susceptibility of *Rhyzopertha dominica* to carbaryl and malathion. Carbaryl seems very effective against this species, reported to be less susceptible to malathion. A very low level of carbaryl, less than 1 p.p.m., killed *R. dominica* under the conditions.

Maize Weevil (Sitophilus zeamais).—The trial in shelled maize, set up in October, 1962 at Grafton, is still in progress. It has been sampled at intervals of about three months during the year. In samples taken 18 months after commencement of the trial, lindane dust at 5 and 10 p.p.m. continued to exert control of insect pests, but there was severe infestation of malathion treated grain (10 and 20 p.p.m.). Control grain had been reduced to shell and dust, and had a bushel weight of only 1½ lb.; while the insecticide-treated grain had a bushel weight of from 44 to 54 lb.

Main insects found at the last sampling were *Sitophilus zeamais, S. oryzae, Tribolium* spp., and *Sitotroga cerealella. Cadra cautella,* earlier found in all treatments except the control, was not present at the last sampling. *S. cerealella* infestation developed after the September, 1963, sampling. The trial is being continued, to determine the length of protection afforded by lindane treatments.

Trials of insecticide treatment of husked and unhusked cob maize were set up in September, 1963, at Grafton. Spray and dust applications of lindane and malathion were made at rates recommended for feed grain. The cobs were stacked in boarded cribs on a barn floor. Insect infestation of the unhusked cobs was severe seven months after commencement, despite treatment; infestation of the husked cobs was reduced by malathion and lindane treatments.

The results emphasised the importance of husking cob maize before storage, to enable effective insecticide treatment. Malathion is more suitable than lindane for treating maize which may eventually be fed to stock, since chlorinated hydrocarbon residues cannot be tolerated in stock food.

Trials of malathion and lindane treatments on cob corn were laid down on two properties in the Kempsey area in June, 1963. Malathion spray and dust and lindane dust performed well up to seven months after treatment. The lindane spray treatment was unsatisfactory.

Sealing of Stored Foods.—Tests of four adhesive tapes used for sealing biscuit tins were commenced in July, 1963. Sealed tins containing biscuits were exposed to a mixed population of *Tribolium confusum, Oryzaephilus surinamensis, Lasioderma serricorne* and *Plodia interpunctella.* Examinations over four months showed that only the polyvinylchloride tape was not penetrated by insects. This tape was easy to apply and appeared to be the most satisfactory tape for the purpose.

VEGETABLE PESTS

Potato Moth (Gnorimoschema operculella).—Continued dry, warm weather provided conditions that resulted in the worst infestation for many years.

In a number of crops azinphos ethyl at 6 oz. a.i./acre, applied by low volume boom, gave complete mortality of all larval stages in mines in the foliage. DDT will not do this unless applied at high volume. Azinphos did not, however, cause any appreciable mortality of adult moths under field conditions.

The present position as regards control by insecticidal methods is not entirely satisfactory. In seasons extremely favourable to the pest, control suffers through inadequate spray coverage of the plants and through nearness of unsprayed volunteer potato plans.

Potato Aphids (Macrosiphum euphorbiae, Myzus persicae).—In recent years virus leaf-roll has been an important problem in certified seed potato crops in the Orange-Millthorpe area. It is the most prevalent and serious virus disease of potatoes in New South Wales and is transmitted from infected to healthy plants by the potato aphid (*Macrosiphum euphorbiae*) and green peach aphid (*Myzus persicae*). The disease is carried in tubers. Prevention of infection of certified seed crops is essential.

Leaf-roll infection occurs following the migration of infective winged aphids from adjacent infected crops and, more importantly, by distribution from plant to plant by winged and wingless aphids which develop within the crop.

Six localities—two adjacent to Orange, two in the area between Orange and Millthorpe and two in the Oberon district—were selected for a trapping programme to determine the incidence of alate aphids in the vicinity of potato crops. Aphids counts were also made in potato crops adjacent to each crop.

Aphids of both vector species were found on potato plants at some stage of the season at all observation sites and many different aphid species were taken in the traps, particularly at sites within three or four miles from Orange. Both vector species were by far the most numerous taken and in only one trap at Oberon was no alatae of either of them taken.

Over 90 per cent of the aphid population on plants at the Potato Research Station, three miles from Orange, were *Myzus persicae,* but at other sites these comprised only 25-50 per cent of the population. At the two sites at Oberon, where aphid numbers were much lower than at other sites, very few *Myzus* were observed. Aphids in small numbers appeared early in January in the Orange district and somewhat later at Oberon and a steady build-up occurred from the end of January. There was a great increase in population at most sites in March, particularly of *Macrosiphum.*

Aphid populations invariably rose following applications of sprays against potato moth. These sprays are ineffective against aphids, but destroy their natural enemies.

A heavy programme of low volume systemic sprays is necessary to keep crops free from aphids, particularly in areas close to sources of re-infestation. At one place where pressure of re-infestation from outside was heavy, sprays of demeton-s-methyl 4 oz. a.i./acre at 10-day intervals from early January to late March were necessary to prevent aphids establishing themselves in the crop. At each inspection a few winged migrant aphids were found, but at no stage were their progeny able to survive in the crop.

Results with menazon 3 oz. a.i./acre and dimethoate 5 oz. a.i./acre in other crops indicated also that control of aphids during the period from early January to late March will require spray applications at 10-14 day intervals. This could involve up to eight or nine applications.

Tomato Pests.—A small trial was carried out at Narara to evaluate carbaryl for tomato pest control. It was used in combination with dimethoate, since adequate suppression of the yellow top vector aphid was not expected of carbaryl alone.

The trellised tomatoes were sprayed once a week from soon after planting out in February until the end of their cropping lives in early June. The treatments were: cuprox alone; dimethoate e.c 0.015 per cent plus cuprox; DDT e.c. 0.05 per cent plus dimethoate plus cuprox; DDT w.p. 0.1 per cent plus dimethoate plus cuprox; carbaryl w.p. 0.1 per cent plus dimethoate plus cuprox.

Heliothis caterpillar attack was very heavy. The weekly dimethoate sprays were quite inadequate, but the two DDT and the carbaryl treatments each gave complete control.

The programme of carbaryl 0.1 per cent once a week caused phytotoxicity, clearly apparent after twelve applications. Compared with the DDT treated the carbaryl treated plants were of generally reduced vigour. They were smaller, paler, with smaller fruits, and showed a lot of leaf-edge yellowing. Less intensive use of carbaryl on tomatoes might not be harmful.

Mushroom Pests.—Mushroom flies and an unidentified Tarsonemid mite were prevalent in a few mushroom establishments during the warmer months.

The Tarsonemid mite severely reduced the fruiting of mushrooms in a tunnel at Picton. High populations of the mite appeared about six weeks from spawning compost in boxes, which were subjected to peak-heat. A lecturer at the University of New South Wales who co-operated in an investigation of this unusual mite infestation of mushrooms found mites attached to mushroom flies. It is almost certain that the flies acquire the mites outside the tunnel and convey them to the mushroom compost in the boxes. There, favourable conditions promote rapid increase in mite numbers.

ANIMAL PESTS

Sheep Blowfly. (Lucilia cuprina).—Six years have elapsed since the first widespread use of an organo-phosphate for flystrike prevention in New South Wales. *Lucilia cuprina,* the fly which initiates most strikes in sheep, is still susceptible to this group of chemicals.

In order to be in a position to recognise any resistance to organo-phosphates, laboratory work was undertaken to establish levels for S. 1751, diazinon, nankor and nemacide to discriminate against susceptible flies. These levels were determined as 0.02 per cent for S.1751, nankor and diazinon and 0.03 per cent nemacide per female fly, treated with 0.5 microlitres per insect by means of a micro-applicator.

Progress was made on the formal genetics of *Lucilia cuprina* to assist with future insecticide resistance studies. Back cross series were undertaken with white-eyed and black-pupal mutant strains. Each character was held through ten generations of back crosses, thus showing that single genes are involved in each instance.

Preliminary genetical tests indicate that these genes are on separate autosomes and are not linked with the gene which confers dieldrin resistance.

Sheep blowflies were fairly active from mid-spring to early summer throughout the slopes and central plains. Flystrike was a concern on properties where preventive treatments had not been made in the early spring. Conditions were unfavourable for fly activity from mid-summer through to the end of autumn.

Advantage was taken of the spring fly wave to compare diazinon (a di-ethyl organo-phosphate) with an experimental di-methyl organo-phosphate SHG.1942, for poll strike prevention in rams at Narromine. Over a twelve weeks' period, wherein 31 per cent strike was obtained with untreated rams, the incidence of strike was 0.1 per cent and 1.6 per cent respectively for the diazinon and SHG.1942 treated rams.

In the event of resistance developing to diazinon and other di-ethyl ester compounds, SHG.1942, together with nankor which also belongs to the di-methyl groupings, may be expected to control the resistance.

Stable Fly (Stomoxys calcitrans).—Stable flies were troublesome on dairy cows at Deniliquin and in the Hunter Valley districts in mid-summer, but populations decreased by the end of February, and there was no increase during autumn. Except for a period of two to three weeks in February, stable flies were not abundant in the County of Cumberland this season.

Ecological observations on this pest indicate that high populations do not occur in summer and autumn months in the absence of lush, green growth of pastures and grasses.

DOMESTIC PESTS

Argentine Ants (Iridomyrmex humilis).—Fifteen new areas infestation were reported, some 175-200 acres in extent, aking a total of 260 areas of infestation, over 6,000 acres, ice the first report of these pests in Sydney in April, 1950.

Prior to 1964, only one infestation (Woonona) had been ported from outside the Sydney area, but two more (Stanwell ırk and Coniston), also in the Wollongong area, have now en found.

A check survey of sprayed areas was carried out between th November, 1963, and 1st May, 1964. The Campaign nit's staff was supplemented by a C.S.I.R.O. Technical Officer upervisor) and Technical Assistant and up to 28 University udents between 2nd January and 27th March. Argentine ts were found in only four of the 156 areas of infestation rveyed. Only a very small proportion of the original infestaons sprayed in these four areas was found to be infested.

145 of the areas surveyed were sprayed between 5-12 years go (1952-1959), thus providing any survivals with ample me to multiply to populations which could have been readily bserved in the survey.

The four infestations (24½ acres, 11½ acres, ¾ acre and ½ acres) in three municipalities have been "spot" sprayed ith 0.75 per cent dieldrin. The two larger areas were first bserved in 1960 and have spread considerably since then. his, and the usual practice of spraying a much larger area an is actually infested, when "spot" spraying, accounts for e comparatively large areas sprayed.

Spraying of new areas of infestation was continued during e remainder of the year and fourteen separate infestations, otalling 266 acres, have been treated with 0.75 per cent ieldrin at rates varying between 75-175 gallons per acre. It is nticipated that all areas of infestation now known will be prayed within the next twelve months.

Houseflies (Musca domestica).—A strain of flies with resistnces to DDT, dieldrin-BHC and diazinon is being cultured s a type species for insecticide resistance studies. A homozyous diazinon-resistant sub-strain was used in a repeated back rosses series to confirm a strong indication that a single ominant gene confers the resistance. Diazinon resistance was eld through eleven generations of test crosses to a diazinon usceptible strain by means of applying a level of the insectiide to remove susceptible flies. Thus it is clear that the esistance is inherited in a simple manner.

This work was undertaken by an officer of Geigy (Ausralasia) Pty. Ltd. working under Entomology Branch superision.

Fleas (Ctenocephalides canis *and* C. felis).—Infestations of back yards and homes by dog and cat fleas were frequent in he Sydney area during December and January. There was a uspicion that fleas may be resistant to chlordane, dieldrin and BHC, but this was not confirmed by laboratory tests. Bichlorvos aerosols were suggested as an alternative to control flea nfestations in the home and proved effective. Back yard nfestations responded to spraying with 0.1 per cent diazinon at the rate of 1 gallon per 500 sq. ft.

SYSTEMATIC STUDIES

Distribution of Taxonomy of Aphids.—In addition to the Rydalmere aphid trapping programme, now in its fourth year, aphids trapped during specific studies of virus vectors of bunchy top, potato viruses and cereal yellow dwarf have been identified.

Many thousands of aphids have been identified in the course of the programmes. Interesting information on seasonal fluctuation of numbers and species, and on distribution, have been obtained.

Study of the Curculionidae.—Newly-mounted curculionid specimens added to the collection amounted to 922 adults, in the following sub-families: Brachyderinae (including Sitoniae) 134; Otiorrhynchinae 29; Ereminae 32: Leptopinae 225; Cylindrorhinae 47; Rhytirrhininae 3; Amycterinae 9; Gonipterinae 4; Rhadinosominae 2; Hyperinae 6; Cleoninae 11; Hylobiinae 3; Pissodinae 1; Erirrhininae 35; Aterpinae 22; Amalactinae 198; Belinae 8; Apioninae 35; Laemosaccinae 1; Haplonychinae 9; Cryptorrhynchinae 32; Rhynchphorinae 14; Cossoninae 25; Barinae 1; unclassified 36. There are now 11,573 specimens in the weevil collection.

Insect Collection.—Considerable material was received from the collection of the late E. H. Zeck. This included hundreds of mounted specimens, microscope slides and spirit material. Also received were many hundreds of invaluable reprints on the taxonomy of the Coccidae and Aphididae, and other groups.

In all, 3,599 insects received during the year were mounted and 1,935 insects were remounted. Some 3,712 insects (excluding weevils) were incorporated into the collection, including many from the Zeck collection. Additions included 70 specimens in alcohol and six specimens of dried material (plants damaged by insects). A total of fifty-nine parcels was packed for postage elsewhere.

Chemistry Branch

CEREAL SECTION

Wheat Crop 1963-64 (27 *pool*).—The 1963-64 crop was a record for New South Wales. In excess of 120 millions of bushels was delivered either to New South Wales Grain Elevators or into the Victorian system, or held on farms for seed and stockfeed purposes. Of this record volume, 110.45 millions of bushels was delivered in New South Wales.

As usual, the official analysis of the two F.A.Q. samples, Northern Zone and South Western Zone, was undertaken by the Chemistry Branch on behalf of the Australian Wheat Board following official declaration of the F.A.Q. standard set in February. Despite the record yield per acre the protein contents for both the northern and south-western F.A.Q. samples were comparable with those of the previous season.

The south-western sample was particularly free milling and with attractive bushel weight and appearance combined with low moisture it was a good example of a soft white wheat.

The north-western sample had less strength than in previous seasons but showed a marked increase in extensible dough characteristics; this combination of properties reflected the changed varietal pattern of the northern areas. Visually the sample was not as attractive as samples from previous seasons nor as attractive as the south-western sample.

N.S.W. Standing Committee on Wheat.—The Cereal Chemist attended the Committee's annual meeting, at the Sydney Chamber of Commerce, to consider recommendations for 1964. No new variety was submitted for inclusion in the sowing recommendations. The Committee's main task was to consider adoption of a recommendation from the Production and Marketing Committee to establish zones in the New South Wales wheat belt with a view to greater homogeneity. To achieve this, the Standing Committee varied existing recommendations, to enable wheats of similar appearance to be grouped into zones while maintaining the interest of wheat producers and ensuring that the varieties so recommended had the necessary agronomic, disease resistance and quality characteristics.

A special meeting of the Committee was held in February, 1964, to consider recommending for release the two new rust resistant varieties Festiguay and Mendos. In light of the quality information submitted and the satisfactory agronomic and disease data the Committee recommended these two varieties for release for 1964 sowing.

New South Wales Advisory Committee on Wheat Production and Marketing.—The cereal chemist has been a permanent member of this Committee set up in 1960 by the then Minister for Agriculture, to study the Commonwealth Production and Marketing reports on wheat quality and in due course furnish recommendations as to improvements which might be effected in New South Wales.

The Committee's final report was presented to the Minister for Agriculture in November, 1963. The Minister accepted the Committee's recommendations, approved of the necessary action to implement them, and authorised publication of the report.

Uniform Quality Testing.—A recommendation of the Production and Marketing Committee was that a Wheat Quality Technical Sub-Committee be appointed to carry out and report upon the Uniform Quality Testing work, the Committee to comprise the Department's cereal chemist at Rydalmere (convenor), the cereal chemist at Wagga Agricultural Research Institute, a representative of the Bread Research Institute of Australia, and a cereal chemist representing the New South Wales Flour Millers' Council.

The Committee as a matter of urgency undertook testing of four crossbreds during January, 1964, due to there being no commercial variety available for recommendation resistant to all common existing rust races. Two of the four crossbreds have since been named (Festiguay and Mendos) and recommended for sowing in the current season.

Festiguay, a hard wheat bred by Mr. E. Matheson, Senior Research Officer at the Department's Tamworth Agricultural Research Station, has an attractive grain with good baking quality especially at high protein levels. It was found to be superior to the check variety Eureka. The Committee found that Festiguay has somewhat overstable dough characteristics which are undesirable at lower levels of protein.

Mendos, the other variety, was developed by Professor I. A. Watson of the University of Sydney. It is a hard wheat showing outstanding, well-balanced dough characteristics and is a most suitable type for the north-west.

The other two crossbreds tested were also bred by Mr. Matheson. Each has quite acceptable milling and baking properties, and they could be released in the near future if they maintain their rust resistance and prove to have suitable agronomic features.

Investigation of Soft Wheat Quality.—Funds for this investigation were available from the New South Wales Wheat Industry Research Committee for the whole of the past financial year.

Development of small scale tests for assessing biscuit quality in the early stages of a plant breeding programme progressed. The Zeleny sedimentation test, the water holding capacity test and the alkaline water retention test have proved valuable. A report on results from the Zeleny test has been prepared for publication.

An experimental flour mill was delivered to the Branch late in the year and will be of great use in milling samples for these small scale tests. Ten soft wheat variety trials are being conducted in the southern irrigation areas. These trials include varieties and crossbreds from Victoria and New South Wales. The grain samples will be tested for suitability for biscuits and other soft wheat purposes. Samples from these trials will also provide material for use in developing the small scale quality tests.

A soft wheat survey in the central west was conducted in the 1963-64 season to determine areas suitable for soft wheat production. Twenty-two silos were included in the survey, from Grenfell and Bendick Murrell in the south to Gilgandra in the north. From the survey the varietal pattern of the central west will be determined and the soft wheat potential of suitable varieties assessed.

The "time of spring irrigation" trial is continuing at Leeton Agricultural Research Station, to ascertain correct timing of a spring irrigation that would provide sufficient soil moisture over the grain ripening period to ensure the production of soft, low protein grain.

An extensive article dealing with soft wheat production under irrigation in southern New South Wales has been submitted to the *Agricultural Gazette of New South Wales*, for publication before the 1964 wheat harvest.

Investigation of Segregation on Basis of Quality.—A further progress report was prepared and presented to the Wheat Industry Research Council, the source of funds for this investigation. Further assistance of the Council has been sought, to permit use of unexpended funds to maintain a laboratory assistant and provide for publication of the final report.

Further composites have been prepared and segregates made of samples from the 1962-63 harvest survey. These are based on a combination of appearance and variety, viz. hard varieties which are visually hard; hard varieties which are visually soft; soft varieties which are visually hard; and soft varieties which are visually soft.

The composites of hard varieties hard in appearance, were strong in character; the composites of hard varieties soft in appearance and soft varieties hard in appearance tended to be equal in quality characteristics, although the latter group had considerably higher protein contents.

These composites were prepared on a zonal basis. It was noticeable that variability due to zonal influence was reduced to non-significant levels for many characteristics.

Statistical analysis showed that, for most characteristics investigated, hard or soft appearance was more significant than hard or soft variety. Though appearance and variety are associated there seem to be factors not common to both.

A barley pearler has been obtained in the hope that this instrument will give, for wheat, results that can be correlated with grain hardness. Preliminary results have shown that resistance of grain to pearling agrees well with flour water absorption and breakdown of the Farinograph curve, but has little or not correlation with protein content.

A central west survey was conducted in conjunction with the soft wheat project. The samples from the survey will be treated in the same manner as were the 1962-63 survey samples.

Royal Agricultural Society Wheat Championships.—As usual, officers of the Cereal Section participated in the testing and final judging of the wheat open class entries, of the New South Wales Royal Agricultural Society Show. The method of judging was altered this year by creation of three championships, so that wheats of similar quality characteristics were competing amongst themselves. The three championships were for strong wheats, medium strong wheats, and soft bread wheats.

Royal Australian Chemical Institute—Cereal Conference.—The Department's Cereal Chemistry was represented at the Annual Cereal Group Conference of the Royal Australian Chemical Institute, held at Toowoomba, Queensland. The agenda provided visits to wheat properties on the Darling Downs, including "Anchorfield" which is closely associated with the Sydney University wheat breeding programmes. The new Wheat Research Institute which was recently established at Toowoomba was also visited.

Laboratory Output and Procedures.—Some 2,020 samples of wheat and flour were received in the Cereal Section and 1,477 samples were experimentally milled, as compared with the average of 710 millings per year for the previous five years. This increase also increased the number of associated laboratory procedures, for example the Farinograph, moisture and flour protein determinations.

The section undertook 4,980 protein analyses. These were done on all wheat and flour samples, also in connection with the two industry-financed projects and a number of Division of Plant Industry projects such as hybrid grain sorghum trials.

Over 2,000 ash determinations were made, a threefold increase on the previous season's total and partly due to the increase in flour exports where ash was included in the specification.

There was a drop in maltose determinations, because existing staff could not cope with larger outputs in certain types of testing without declines in other spheres.

Certification of Export Wheat and Flour.—Increasing demands have been made for certification services in relation to wheat and flour shipments. Over 78 million bushels of wheat (2,092,478 tons) was exported from Sydney and Newcastle terminals, and 58.2 million bushels (74 per cent) was subject to full Departmental certification. This 58.2 million bushels was carried in 105 cargoes and included premium wheat, northern F.A.Q., south-western F.A.Q. and Off Grade shipments. Most of the wheat went to Russian and Chinese ports.

In a few instances the selling authority was unable to meet the buyer's specifications with regard to moisture content but apart from these cases where northern wheat was concerned, other specifications for such factors as bushel weight, protein content and admixture were met in all cases.

Requests for flour certificates greatly increased, although most shipments were small. Seventy-four flour certificates were issued. Only 13 were shipments of 1,000 tons or more. In January the cereal chemist, acting under authority of Commonwealth Export Regulations, refused delivery to one flour mill until its flour met the required specification. Policing of export flour quality is still inadequate and this points to the need for full-time staff and facilities to handle export certification of wheat and flour.

PESTICIDES SECTION

Chemical and Biological Properties of Sheep Dip.—Investigation of mixed sheep dips containing an O.P. (organic phosphorus) pesticide and lime sulphur for control of sheep external parasites has been undertaken in association with Glenfield Veterinary Research Staiton. Four O.P. compounds in the form of emulsions at field strength have been used with 1 per cent lime sulphur solution. Measurements have included the effect of age on the lime sulphur and the O.P. compound in the dip, and the amount of O.P. compound deposited on the sheep as a result of dipping. So far the number of sheep used has been limited, to minimise the effect of "stripping" or dip depletion.

Biological measurements of the decline of lice infestation of the dipped sheep were recorded for the mixed dip and dilutions of it.

Results so far show that whilst the lime sulphur is virtually unaffected, most of the O.P. compounds breakdown owing to the alkaline conditions conferred on the dip by the lime sulphur. Biological observations are not yet complete.

Removal of Excess Spray Residues on Fruit.—The investiation this year has proceeded along the following lines:

The mercury content of nine samples of apples from the 963 crop, received from Batlow and Orange, were found o range from 0.002 to 0.052 p.p.m. (average 0.023) in the whole fruit. The average amount in the peel was 0.009 p.p.m. and in the flesh 0.014 p.p.m.

Two samples of apples which had been sprayed with phelam (phenyl mercuric dimethyl dithiocarbamate) during trials at Orange, were analysed for mercury residues. Ten spray applications of phelam were made, and samples were taken six weeks and eleven weeks respectively after the last application. (The normal minimum interval between last spraying and harvesting, for mercury compounds, is four months). The results were:—*Sample* 1, 0.010 p.p.m. in the whole fruit; *Sample* 2, 0.007 p.p.m. in the whole fruit.

The programme for 1964 is proceeding with the following determinations:—(1) *Mercury*: (a) in apples from trees which have received an eradicant spray after removal of the previous crop, but which have not since been sprayed with mercury; (b) in apples of the three main varieties, Granny Smith, Delicious and Jonathan, which have had uniform mercury spray treatment. (2) *Azinphos and Carbaryl*: rate of breakdown on the fruit after harvest.

From each of three orchards at Griffiths two groups of apple samples were taken from trees that had been sprayed fairly heavily with azinphos. Each group of samples consisted of eight subsamples, each containing 16 apples. The eight subsamples from each of the six groups are being analysed at appropriate intervals, to measure rate of breakdown of pesticide residue on the fruit after harvest. The samples are being kept in the cool-room at about 36°F. during the trial.

A similar set of samples (48 in all) of apples which had been sprayed fairly heavily with carbaryl was received from Griffith. A similar trial to measure rate of breakdown of pesticide residue on the fruit is being carried out.

Results are as yet incomplete but the figures so far indicate that the azinphos and carbaryl residues decompose slowly under the conditions of the trial.

Misting of Vegetable Crops.—Deposition, retention and distribution characteristics for DDT on foliage and stems of trellised tomatoes from the 1963 autumn season were assessed. The higher rates of application gave higher deposits of DDT; exclusion of copper oxychloride from the misting fluid appeared to adversely affect DDT retention on foliage and the upper stems of plants. Because insect pest incidence was lacking during these experiments, further work is needed—to correlate rate of application, deposits and biological control in a season of high pest incidence.

No field misting experiment was carried out in 1963-64, but development of a suitable method for the determination of carbaryl residues on foliage was investigated. Most of the available methods for carbaryl residues employ clean-up procedures. These limit the number of analyses which can be attempted. The method developed does not require a clean-up procedure, gives virtually 100 per cent recovery of carbaryl, and has been tested with excellent results on tomato, bean, cotton, citrus and apple foliage.

Insecticide Residues in Animals.—Due to the growing importance of Australia's export meat trade, it is becoming increasingly necessary to investigate pesticide residue levels resulting from implementation of recommendations for control of pests of livestock.

DDT applied at 2 and 4 oz./acre has given good control of red legged earth mite in pastures, but DDT residues on pasture when ingested by grazing stock tend to accumulate in the animal fat depots and also in meat tissue. An experiment to investigate DDT residue levels on pasture and in grazing sheep from those treatments was set up at Leeton Agricultural Research Station in the late autumn of 1964. Studies of the effects of formulation, rate of application, and withholding periods have been commenced.

Insecticide Residues on Grain.—Malathion treatment of grain to eliminate weevil infestations is now becoming standard practice at country storage centres and terminal silos. Problems in the application of correct malathion dosages, and the sampling of various types of silos to check malathion residues on treated grain in country centres, have been discussed with the Grain Elevators Board.

Insecticide for Plague Locust Control.—Nine tons of lindane previously held by Government Stores Department are being formulated by a private firm into 13,000 gallons of 15 per cent emulsifiable concentrate for later use in controlling the plague locust in inland areas. The formulation must be in accordance with Departmental specifications.

Tests on products from various firms tendering for the contract showed that one firm submitted a low cost material with a flash point well below the minimum specified. Follow-up tests in material supplied under contract by the successful tenderer showed that it fully met the specification.

National Health and Medical Research Council Sub-Committee re Pesticides Residues in Food.—The Chemistry Branch was represented at the two meetings of this Sub-committee this year.

Conference on Residues in Agricultural Products.—At a conference on residues in agricultural products, jointly organised by The Australian Institute of Agricultural Science and The Entomological Society of Australia (N.S.W.) held in August, 1963, a paper on "Pesticide Spray Residues on Fruit" was read by an officer of the Chemistry Branch.

Australian Standards Association Pesticides Sub-Committee.—The Chemistry Branch continued to be represented in this Sub-committee. Specifications for phenothiazine and hormone weed killers were drafted and sent out for postal ballot.

WATERS SECTION

Central Water Testing.—Generally satisfactory seasonal rainfall and supplies of water from suitable sources have this year reduced the number of water samples submitted to the headquarters laboratory at Rydalmere for analysis and report; 512 samples, representative of new bores, wells, etc., and problem waters affecting crops and stock and rural domestic use, were dealt with by analysis and report.

Decentralized, Regional Water-testing Services.—This service, inaugurated in 1959, continued to serve landholders by on-the-spot analysis of waters and soils for salinity and pH status. Some 1,700 samples of water and soils were dealt with, and advice based on the analytical data was communicated.

The value of this decentralised service is speed and convenience, obviating despatch or transport of samples to the headquarters laboratory at Rydalmere. In many instances, too, the advice is better communicated to farmers through in-contact demonstration by and discussion with the Regional extension officers trained in the analytical techniques and interpretations.

At Tullakool Soldier Settlement Area in southern New South Wales reclamation of salt-affected land to pasture has been experimented with by cropping to pre-germinated and aerially sown rice in prepared bays. Control of salinity in the paddy waters, and soil tests prior to sowing, in course of cropping, and after harvest, involved analyses of some 400 samples of soil and water. These were effectively done with a Regional Water and Soil Salinity Test Kit. This on-the-spot service was invaluable to the success of the experiment. Results have shown that by pre-cropping to rice under controlled leaching the soil salinity can be reduced to levels that allow pasture establishment in the following season.

Co-operation with other Governmental Bodies.—Service to the N.S.W. Water Conservation and Irrigation Commission has been maintained by analysing and reporting on water samples submitted. The decentralized water testing service at Orange, N.S.W., analysed and reported on 129 samples of water submitted by the Commission through its Dubbo office. Samples submitted and reported on through Rydalmere totalled two hundred.

Research.—Research initiated in 1961-62 into development and use of a specially designed soil-moisture block to determine irrigation needs has been continued. Trials using these "Moistest" blocks in conjunction with the "Salitest" meter, previously developed at Rydalmere, have been done at Richmond with potatoes, and the periodical readings taken with the meter have been graphed to show the cyclic variation of moisture in the crops' root zones.

Laboratory experiments were carried out with the "Moistest" gypsum blocks with two widely different textured soils, a loamy sand and a clay. The purpose was to study the relationship of change of "Salitest" meter readings with moisture reduction in these soils on a drying cycle, and to determine the reproducibility of these readings over a number of cycles and with different "Moistest" blocks drawn at random from production. Graphs constructed to record these relationships have been published.

The "Moistest" blocks and "Salitest" meters are in use in all States of the Commonwealth and in New Guinea, and press reports of their success have been published in South Australia.

Automatic Irrigation.—Progress has been made in development of equipment for automatic control of irrigation, using "Moistest" gypsum blocks in conjunction with an electronic control unit. A prototype of the latter has been made and given preliminary acceptance-testing. The control unit, powered by a 12 volt car battery, receives impulses from the gypsum blocks set in the root zones in soil and automatically switches irrigation water on and off—reflecting the amount of available moisture in the soil.

Some changes in electronic circuitry in the control unit are in hand, to reduce drain on the battery and to provide for part-time sensing in lieu of the continuous sensing in the original unit.

Extension Services.—Extension services have been actively performed throughout the year by the agronomist (water testing specialist) and by headquarters personnel, in addresses and lectures at Departmental irrigation schools, Agricultural Shows, and field days and other organised group occasions.

REGULATORY AND GENERAL CHEMISTRY

Stockfeed Vitamin A Project.—Analytical work on the first stage of this project, relating to stability of Vitamin A incorporated in poultry mashes, is nearing completion. A paper will shortly be submitted for publication.

The work on Vitamin A stability is to be extended to cover a range of pelletted stockfeeds.

Stockfeeds.—Samples of registered stockfeeds have been examined for compliance with requirements of the Stock Foods and Veterinary Medicines Act. Several meat meals were found to be of poor quality. Resulting from these analyses and current investigations at the Seven Hills Poultry Research Station, proposals have been submitted regarding alteration and/or extension of regulations under the Act relating to meat meal quality.

Veterinary Medicines.—A well known veterinary medicine used against internal parasites was examined following reports that it had been ineffective in treatment of pigs. As a result the Department released a press statement urging care in handling and storing this type of product.

Margarine.—Samples of table and cooking margarine were examined for Division of Dairying, including the recently introduced product made from a type of vegetable oil not previously used in margarine manufacture. By analysis the possible composition of the fat components was assessed.

Honey.—Samples of different types of honey were submitted for analysis to determine whether they complied with Japanese specifications. An export market exists for New South Wales honey of satisfactory grade. The samples conformed with the specification.

Oil-impregnated Fruit Wraps.—Further checks were made on wraps delivered to packing houses in Orange and Griffith. Most wraps were found satisfactory, but some apparently had insufficient oil to adequately protect the varieties of apples most susceptible to scald.

Snail Bait.—In collaboration with Entomology Branch, a widely-used type of snail bait alleged to be attracting and poisoning animals was tested. No ingredient normally considered attractive to animals was found, and the composition was basically in accordance with the registered formula.

PHYSICO-CHEMICAL AND ISOTOPES SECTION

Zinc Analyses Method.—Zinc deficiency is found in citrus, pome and stone fruit in nearly all fruit growing districts from the central coast to the Darling River. The deficiency occurs also in other crops.

The polarographic method has been used in Chemistry Branch for analysis for zinc for a considerable time. The zinc has to be separated from interfering substances before it can be measured with the polarograph. Hitherto the reagent "dithizone" has been used to effect a separation, but has never been quite satisfactory.

Early this year the ion exchange resins were established as suitable for separating the zinc for analysis with the polarograph. The resins gave a much more satisfactory separation than the "dithizone" reagent. This has been confirmed, and the precision and reliability of the method have been studied. The investigations have involved considerable replication.

Of particular significance in effecting precision has been contamination by zinc derived from, and adsorption of zinc by, the glassware. These influences have been studied in detail to establish procedures to minimize their effects and obtain highest possible analytical accuracy.

Because of the availability of a reliable zinc analysis method, work has now extended from the diagnostic field to the study of many aspects of zinc nutrition.

Rice Leaves and Grain.—Over 50 samples of leaf and grain from rice plants grown in the M.I.A. were analysed semi-quantitatively for trace elements, using the Large Spectrograph Cathode Layer Technique. Some 18 trace elements were found. These included zinc, manganese, copper, nickel, cobalt and molybdenum. The samples were not originally collected with a view to trace element analysis; thus a high degree of possible contamination within the samples was incurred. No definite conclusion could be drawn, but the results indicated the need for further investigations into the nutritional status of rice plants.

Atomic Absorption Spectrophotometry.—Establishment of the new analytical technique of Atomic Absorption Spectrophotometry within the Spectrographic section was approved. Finance for equipment to set up this new technique was provided from the Wheat Marketing (Barring of Claims) Fund.

Since the new method of analysis would replace the Lungegardth Flame Emission Analysis for calcium, magnesium, manganese, sodium and potassium using the Medium Spectrograph, a decision was made to convert this latter instrument to an Atomic Absorption Spectrophotometer. Conversion involved replacement of the photographic plate method of recording the spectrum by a direct reading method using photomultipliers, amplifier and read-out meter. All of the equipment for the conversion was commercially available except a housing for the photomultipliers. This housing which is attached to the spectrograph was designed by Mr. C. Short of this Section.

The Atomic Absorption Spectrophotometer has been initially set up to analyse for calcium, magnesium, manganese, sodium, potassium, iron, zinc and copper.

The analytical ranges in solution for each element are: Ca: 0.2 to 10 p.p.m.; Mg: 0.01 to 4 p.p.m.; Mn: 0.5 to 20 p.p.m.; Na: 0.1 to 4 p.p.m.; K: 0.1 to 5 p.p.m.; Fe: 1 to 20 p.p.m.: Zn: 0.1 to 5 p.p.m.; and Cu: 0.5 to 20 p.p.m. Interference tests have been carried out on each element at the ranges of major nutritional elements found in plant samples. The only interferences found at these levels were phosphorus and aluminium on calcium and magnesium, and by adding a large amount of strontium to the solution these interferences were removed.

This new technique will greatly speed up the analyses process for major nutritional cations, and the number of cations covered on a routine basis will be increased from five to eight. Greater accuracy and sensitivity also are achieved by the new method. The instrument will analyse any type of agricultural sample for the eight cations mentioned previously.

Large Spectograph.—Anode excitation in lieu of cathode excitation (sample in anode instead of in the cathode) is to be used on the large spectrograph. Pre-formed electrodes will be purchased at a price comparable with cost of electrodes shaped in our own laboratories. This will save considerable time and through more uniform electrode dimensions will yield more accurate analyses. A micro-mixer mill has been purchased; for more uniform sample mixing, time saving, and accuracy.

PLANT NUTRITION SECTION

Analysis Output.—Some 19,000 analyses were done. There has been a steady increase from about 5,000 per year five years ago.

Sulphur Determination Method.—Equipment has been obtained for a new method, outlined by Nishita and Johnston, used extensively for diagnostic purposes in California and other parts of the U.S.A. It is particularly suitable for sulphate determinations for which there is a large demand at present. Near to 1,500 samples from Toxaemic Jaundice trials in the south-west are being held pending determinations for calcium, molybdenum and sulphate sulphur.

The method is not only useful for sulphate determinations. It is effective also for total sulphur.

Citrus Survey, Maroota District.—A good deal of work has been done over the last three years in relation to citrus magnesium deficiency. Previously it had been reported that magnesium deficiency was not corrected in citrus by the magnesium type of fertilizers normally used, namely magnesium carbonate, magnesium sulphate spray and dolomite.

A survey of the extent of magnesium deficiency in the Maroota and Hills district showed that almost all orchards on the lighter soils were affected with magnesium deficiency and in many cases orchards had not responded to magnesium carbonate. Dolomite had not been used to any great extent.

The extent and incidence of the symptoms have now been further surveyed. Leaves have been collected at regular intervals and analysed. Good correlation between amount of magnesium in the affected leaves and orchard incidence of symptoms was found.

By overseas standards, spring flush leaves which do not show symptoms should contain about 0.2 per cent magnesium. In the survey it became apparent that these standards did not necessarily apply in the Hills district. Very many of the spring flush leaves contained more than 0.3 per cent magnesium although magnesium deficiency incidence in older leaves was fairly high. The spring flush leaves were not a very good indicator of magnesium deficiency. However, magnesium level in the affected older leaves was highly correlated with incidence of symptoms.

This year a number of paired plot trees have been selected on seven properties. Five rates of magnesium carbonate and also one rate of magnesium spray at 10 lb. magnesium nitrate have been applied to each of the paired trees. Leaves from the individual trees are being analysed for magnesium. Effects of magnesium carbonate will be observed on the paired trees, in relation to time for correction of symptoms as well as run down after correction.

Advisory Work based on Plant Analysis.—During the magnesium survey, samples from many Hills district orchards were collected also for analysis for nitrogen, phosphorus, potash, calcium, magnesium, manganese, etc. These results were examined in collaboration with representatives from the Division of Horticulture and Biology Branch and advisory recommendations were made.

Although there are many limitations as far as testing is concerned, and calibration and sampling are of utmost importance, the Chemistry Branch is now able to offer a plant analysis service in relation to citrus if arrangements can be made for the mechanics of sampling.

Apple Research.—Work on leaf analysis continued on a number of apple orchards in the near Sydney districts, Oakdale, Penrose and Wedderburn. Leaves are collected at regular intervals and analysed for N P K and at spot intervals for calcium, boron, zinc, etc. The nutrient leaves vary from month to month and the pattern appears to be fairly consistent each year. N P K levels are high in November and December, fall off in January-February, and remain fairly flat over March-April. There is also general variation of the overall level of nutrients from year to year in many cases.

Inter-departmental Review Committee.—This committee, representative of Division of Horticulture, Division of Plant Industry, Division of Animal Industry and Division of Science Services, is now permanent. Demand by the Divisions for analytical work has been so great that decisions by the committee have been necessary to establish priorities and concentrate analytical effort accordingly.

Liaison with Fertilizer Companies.—Fertilizer companies, producers of superphosphate, importers of potash and manufacturers of nitrogenous fertilizers have maintained continual contact with the Chemistry Branch in relation to problems of mutual interest.

An article on "The effect of particle size on the availability of brimstone sulphur to white clover" by R. G. Weir, B. Barkus and W. T. Atkinson, has stimulated a good deal of interest by the superphosphate manufacturers who fortify superphosphate with the addition of sulphur. This article dealt with results of trials, extending over a number of years, showing that residual effect of elemental sulphur may be fairly high by comparison with that of sulphate sulphur—although its initial availability is not so high; availability of elemental sulphur is however largely determined by particle size.

Contribution to Grasslands Conference in Melbourne.—An officer of the Branch, Mr. R. G. Weir, was co-author of a paper "Phosphorus and Sulphur Ratios in Fertilizers for the establishment and maintenance of Pastures" for the Melbourne Grasslands Conference, with members of Division of Plant Industry. The paper gave rise to discussion of several contentious matters. Southern workers claimed that sulphur is not required at establishment and that at no stage has pasture any requirement of sulphur above what is normal in superphosphate. The paper presented evidence on phosphorus and sulphur to show that sulphur was definitely required by pastures at establishment at Walcha and also that there was a large demand for sulphur in the later life of the pasture.

Farmer Schools.—Lectures were delivered by officers of the Nutrition Section to pasture and animal husbandry schools at various centres, including Mudgee, Cowra and Cooma, to organisations at Arcadia, Mildura, also at the University of New South Wales and the Agricultural Bureau State Congress.

SOILS SECTION

Soil Phosphorus Studies in Pasture Soils

U.P.S.E.T.—Soil samples from the Uniform Pastures Survey and Establishment Trials (U.P.S.E.T.) conducted by Division of Plant Industry continued to be tested for soil phosphorus. Of main interest in this series are the "rates of superphosphate" and "rates of sulphur and phosphorus" trials.

Tentative soil phosphate ratings have been given to each soil on the result of soil P test. Soils data have yet to be correlated with yield data.

Shannon Vale Nutrition Station.—On this granite soil the effects of varying rates of superphosphate on animal production, with varying sheep stocking rates, under "strategic" grazing conditions, are being studied.

The long superphosphate history of the paddocks provides the chance to study both sulphur and phosphate residual effects. The superphosphate totals applied up to the time of the current experiment range from 1 cwt. to 26 cwt. per acre.

Lowered Residual Phosphorus on a Northern Tableland Soil.—In a trial near Walcha, soil phosphate test levels continued to decline. This trial was last topdressed with superphosphate in 1961. At this date, the totals applied over a period of eight years ranged from nil per acre on the control to 32 cwt. per acre on the plots receiving the highest rate. Soil P analyses were done in 1962, 1963 and 1964. Results indicate that residual value of applied superphosphate has declined to the native P level in all plots except that which received the highest rate, 4 cwt. per acre/annum. Residual P level on the latter is expected to drop to that of the native soil in the ensuing year.

North Coast Pasture Superphosphate Trials.—Soils in the Grafton area are known to be deficient in plant-available phosphorus and nitrogen. Soil P tests on a number of soil types in the area including granitic, sedimentary shales, sandstones, and coal measures, indicate very "low" levels of available phosphorus. A project financed by Cattle and Beef Industry Research Committee funds has been commenced in this area to study the responses of summer legumes and white clover to varying initial rates and varying maintenance rates of superphosphate. Also, trials have been laid down to determine the comparative response of these species to the sulphur and phosphorus contained in superphosphate.

Seven sites were sown with the summer legume *Lotononis bainseii,* using three different levels of applied superphosphate. Comparative trials, using white clover, have been established at each site. Cyclonic rains in March so eroded the plots that four sites had to be re-located; the other three remain for observation.

Various chemical analyses have been carried out on representative sites, including for pH, total nitrogen, cations, organic carbon and phosphate. Results indicate generally low fertility status, and that potash is probably marginal on most of the soils.

Initial observations on response of the two clovers to superphosphate indicate that *Lotononis* shows less response than does white clover. The trials will continue for a number of years.

Soil Phosphorus Studies in Wheat Soils

Ten wheat fertilizer trials have been established in the central west. The project has been designed to refine what is already known of correlation between soil P test and wheat response to superphosphate in this area; the data obtained from Wheat Uniform Fertilizer Trials (W.U.F.T.) in 1959-61. The experiment is a factorial with five rates of superphosphate and five rate of sulphate of ammonia.

A self-contained mobile unit is "stream-lining" the trials. It comprises combine drill, tractor, low-loader trailer, cabin truck, harvesting machine and utility.

The defined area of work extends from Condobolin (headquarters) in the west to Wellington in the east, and from Dubbo in the north to West Wyalong in the south. Sites were selected on the basis of a preliminary soil sampling of areas approximately the size and shape of the experiment "block". Heron was the variety sown this year in all of the trials.

This work will continue for three to four years.

Soil Potash Investigations

Millet Studies, in Pots.—In October, 1963, the main project was re-commenced and so far three complete cycles of planting, growth and harvest have been completed.

The work is progressing as planned, now that the seedling maggots problem which interrupted the project last year is under control. It has been possible to show that some soils very soon respond to potash although not originally deficient.

Wider Field Work.—Increasing emphasis is being placed on soil potash. This has widened the field of work. Considerable field work will have to be commenced much sooner than anticipated. To this end, co-operation with Division of Plant Industry has already commenced in three fields.

This year soil samples were received from all Potato Uniform Fertilizer Trials (P.U.F.T.) and will help a decision on what potash levels are adequate for potatoes and vegetables generally.

Further, a soil potash study has been undertaken on two grazing trials at Cowra Agricultural Research Station. These are long term trials. Comparisons will extend over a number of years.

Lastly, a programme of field experiments on the important pastures areas of the south coast has been commenced with the District research agronomist. Possible sites have been sampled and the trials should be launched shortly.

Citrus Nutrition Experiment

The aim of soil analyses carried out on the Narara citrus pot experiment soil samples was to see the correlation of nutrient level in the soils with leaf nutrient levels and other measurements on the trees and fruits.

First a chemical extracting procedure had to be found, to determine the nutrition status of pot soils as resulting from the various fertilizer treatments. Earlier analyses had shown in the samples a considerable amount of soluble salts accumulated by the monthly application of different fertilizer rates. Some free carbonate, as calcium and magnesium carbonate, as well as soluble salts, accumulated in the first and second year. Consequently it was necessary to estimate both soluble and exchangeable forms of nutrients.

For all soil samples collected during 1961, 1962 and 1963, the pH, total exchange capacity, exchangeable hydrogen, calcium, magnesium, potassium, sodium and manganese, sum of exchangeable and acid soluble calcium and magnesium, total exchange bases and avaliable phosphorus, have so far been determined. For phosphorus, Bray's No. 2 (Fluoride) method was used.

The results were compared with the amounts of nutrients applied during the experiment from 1956 to 1962. Many of the soil samples have shown a far greater amount of nutrient than was applied. This is due to accumulation of added nutrients in the surface depth sampled (0 in.-3 in.). Calcium, magnesium and phosphorus showed very often an extremely high level. Potassium was the only exception, probably because its higher solubility gave better distribution in the pot. Uptake and solubility of potassium were each higher than for the other elements.

The anlayses results of the soil samples will be submitted to the Biometrician's Branch after nitrogen and copper analyses are available. The analytical data of the soil samples can be used in the second step, to correlate with levels of nutrients in the leaves.

Manganese Toxicity

The first "correction of manganese toxicity" trial on beans at Terranora Vegetable Station indicated that some soils could have a toxic amount of manganese. Manganese levels were obtained from composite soil samples. From last year's soil analyses and results for individual plots there appears to be some correlation between plant manganese uptake and available manganese content of the soil. Further work has to be done to confirm this observation.

The highest manganese contents were found in soils from the "lime-untreated" or "low lime-treated" (10 cwt./acre) plots and these soils had the lowest pH values. The available manganese level trended lower in the second year after the lime treatment, and no toxic symptoms were reported in that second year (1963). Some doubt has been cast on reliability of these analyses, because Tick Control regulations required fumigation before the soil samples could be despatched from the Tick Quarantine areas concerned.

To establish the distribution of soils in Murwillumbah district possibly prone to manganese toxicity, a preliminary survey was done in November, 1963. The results from soils from that survey showed available contents varying from 0 to about 60 p.p.m., and reducible manganese up to 500 p.p.m. Manganese content decreased with depth, with most in the surface layer.

There was correlation between pH value and exchangeable manganese content of the soil. Higher manganese content occurred at low pH. Virgin soils adjacent to the cultivated paddocks had a considerably lower manganese content than those of the arable soils where, French Beans having been grown for years, sulphate of ammonia has been applied in large quantities. The facts clearly evidenced the acidifying effect of the sulphate of ammonia—making more manganese available for plants and in some cases leading to manganese toxicity.

To detect the toxic level of manganese, and towards correction of the toxicity, a new experiment was planned and commenced this year at Terranora Vegetable Research Station. In this, ranges of six sulphate of ammonia and six lime treatments have been applied on plots—with all combinations and with one replication. A comprehensive soil analysis programme will be fulfilled in conjunction.

Soil Salt

Nutrient and Salt Analysis of Soils from Tile Drain Spacing Experiment.—Chemical analyses of samples collected before leaching (August, 1961), and after leaching (March, April and October, 1962), from this experiment at Griffith Horticultural Research Station have now been completed. The results have been statistically analysed.

The following determinations were made on the 784 samples:—moisture content of the saturated paste and, on the saturation extract, pH, electrical conductivity, hydroxyl, carbonate, bi-carbonate, chloride, boron, sulphate, magnesium, sodium, postassium, calcium.

Statistical analyses, applied to the electrical conductvity, sodium and chloride results compared the five treatments at each depth, before and after leaching. In each case, no significant difference between the before and after leaching samples was found for any depth. Inadequate sampling technique is an explanation of the negative result. Single samples only were taken. Since salt is one of the most variable of soil constituents, the fact that no significant difference was detected between the before and after leaching samples—although an undetected change in salt levels may have taken place—is not surprising.

In October, 1963, a further 276 soil samples were taken. These are the initial samples for nutrient analyses, and for comparison with samples to be taken in the ensuing five to seven years. The sampling technique involved two duplicate samples, each a composite of five separate samples. All samples in each pair of composites were taken along a line parallel to the tile drains, thus representing a particular distance from the tile line.

Analyses of these initial samples have been completed. The analyses listed for the 1961 and 1962 samplings were carried out on these October, 1963, samples. Also, exchangeable hydrogen and aluminium, calcium, magnesium, sodium, potassium and cation exchange capacity were determined; as were total nitrogen and phosphorus determinations on behalf of the samples.

Considerable variability was noted between duplicate results, and statistical analyses showed highly significant difference between the duplicate composite samples. Thus this sampling method is not adequate for the area being studied. A more satisfactory sampling method has to be devised.

A further 270 soil samples were collected in April, 1964, to investigate soil variability and determine a satisfactory sampling method. Analyses of these samples is almost complete.

Thirty soil samples were taken, along a line 40 ft. long, and parallel to the tile lines. These samples were not bulked, but kept separate and analysed individually for pH, electric conductivity, sodium and chloride. From each set of 30 results, the standard deviation and coefficient of variation were calculated.

The coefficient of variation showed that thirty samples taken along the 40 ft. line is an adequate method to sample the area for pH. However, a much larger number of samples will be required to obtain a reliable estimate of sodium and chloride and electrical conductivity.

With a larger number of samples required, soil sampling becomes quite impracticable, owing to soil disturbance, and labour problems in obtaining this large number of samples.

A possible alternative would be *in situ* determination of moisture and salt. This could be by means of calibrated gypsum and nylon blocks buried in the soil, and daily readings; the gypsum blocks would be for moisture determination and the nylon blocks for salt determination. Thus, complete salt cycles could be followed with time, and this would be much more valuable than salt estimated from soil samples taken at six or twelve monthly intervals without knowledge of intermediate salt levels.

Soil Surveying

Barham Stage III Survey.—A Stage III survey was completed at Barham in July, 1963. A report has been submitted for printing.

Clarence Valley Surveys.—Primary field investigation was undertaken in November and December, 1963, on the Mid Clarence Valley Reconnaissance survey, using air photos. Compilation of analytical maps was undertaken, viz.:—Available Relief, Local Relief, number of undulations per mile, drainage pattern and order slope characteristics, geology, lithology and catchment pattern. These maps are now being collated in one map which will become the Semi-Detailed Airphoto Interpretation Map for Landscape Delineation.

That work was delayed by lack of a suitable base map. This will be a more acute problem in the Upper Clarence Valley. There are no military maps for this area, and the topographic maps will have to be constructed on the Lands Department Photo. Indices at a scale of 1 inch—2 miles. These maps show the flight lines and photo. centres, hence orientation of photos. will be simplified, although map construction will require use of a Zeiss Aero sketchmaster.

Gwydir Survey, near Moree.—A Gwydir reconnaissance survey near Moree was carried out with officers of the New South Wales Water Conservation and Irrigation Commission. The field work was completed in March, 1963. The Water Conservation and Irrigation Commission has undertaken to produce the map and reports.

DAIRY CHEMISTRY SECTION

Dairy Salt.—Physical and chemical characteristics for five dairy salts commercially available in New South Wales have been investigated.

Salts available from South Australia and Victoria contain calcium, magnesium and sulphate ions in amounts which are more than optimum for the best flavour when these salts are used in butter. Grain size of 60-90 mesh has been demonstrated to be sufficiently fine for dairy purposes.

A report has been submitted for publication in *The Agricultural Gazette of N.S.W.*, and a further paper is being prepared for *The Australian Journal of Dairy Technology*.

Serum Dispersion in Butter.—A review of relevant factors was published in *The Australian Journal of Dairy Technology*, December, 1963. A low temperature water bath was constructed for controlled temperature treatment of cream samples prior to churning. Microscopic and electrical examination of serum dispersion will determine the effect of these different temperature treatments.

Electrical Conductivity of Butter.—A conductivity cell suitable for commercial application in butter has been developed. The conductivity-serum dispersion relation has been verified following publications by workers in Britain and South Africa. The conductivity of butter is related to micro-biological keeping-quality of butter, and a practical instrument will greatly aid selection of butters for storage.

The instrument is being developed in co-operation with a Sydney firm of electronic engineers. It should be available before the end of 1964.

Butter Moisture and Salt Survey.—Moisture and salt analyses were done on samples taken by officers of the Division of Dairying in the 1963-64 State Butter Survey. Moisture results were unexpectedly low. Recommendations have been made to ensure that future samples are adequately protected against moisture loss.

Cheese Moisture, Fat and Salt Survey.—Samples taken by the Division of Dairying have been submitted for moisture, fat and salt analyses.

YANCO RESEARCH LABORATORY

Rice Chemistry

Analyses Statistics.—About 1,250 samples were analysed this year; comprising some 500 plant samples, 250 dry soils; 400 wet soils and 100 grain samples. Total nitrogen was determined in all samples, except the wet soils. Exchangeable ammonium nitrogen was determined on all soil samples, with prior incubation in case of dry soils. Phosphorus was determined on a number of plant and soil samples.

Tiller counts and leaf-area measurements were done on experimental crops and some commercial crops.

Experiments.—The rice research included: (1) a greenhouse trial of 18 pots holding 5 lb. of soil, to study ionic migration of nitrogen carriers; (2) a large scale trial of 90 plots each holding 300 lb. of soil and containing 30 rice plants in an area of ½ square yard; (3) analyses of some 200 district rice soils, and derivation of the fertilizer requirement for the rice crop; (4) rice quality testing, to establish a firm basis for evaluating new varieties and local quality variations.

Results of trials showed substantial increase in grain yield, without maturity delay, by application of relatively large amounts of nitrogen at the appropriate stage in plant growth.

Estimates of fertilizer requirements in the M.I.A. and Coleambally areas were satisfactory. Results of trials and fertilizer estimates in the Murray Valley showed the need for further nitrogen studies there.

Fruit Chemistry

Analyses Statistics.—About 5,000 analyses were completed. These analyses related to leaf and soil samples taken mainly from peach and citrus orchards where Departmental research projects are located. Also, some samples were from a dozen problem orchards.

Of the total, 408 determinations for each of the elements nitrogen, phosphorus and potassium were completed on leaf samples, as were 336 determinations for each of the elements calcium, magnesium, sodium, boron and chloride. Sixty-four analyses on leaf material were completed for each of the elements iron, manganese, zinc and copper.

On soil samples, 145 pH and conductivity determinations were completed, in addition to twenty lime-requirement analyses. Over 100 analyses on exchangeable soil nutrients were completed for each of the elements phosphorus, potassium, magnesium, calcium, sodium, chloride and manganese; and 120 analyses relating to gypsum requirement of soils were completed. Twenty-seven analyses on exchangeable soil copper were done.

Among the miscellaneous analyses were forty ethylene dibromide determinations relating to periodic samples of the gas taken from fruit fumigation chambers in Griffith.

In addition to the analyses work, the section collected 300 leaf samples and 100 soil samples from sites within a 40-mile radius of Yanco.

Peach Nutrition Studies.—Analyses were completed for nitrogen, phosphorus and potassium, on leaf samples obtained at monthly intervals over three growing seasons from twenty-three peach orchard sites in the M.I.A. During a given season nitrogen levels differed little from site to site, though considerable variation occurred from one year to another.

In the first season, 1961-62, nitrogen levels tended to fall linearly from about 4 per cent in October, 1961, to 2 per cent in April, 1962.

In the second season, 1962-63, nitrogen levels fell much less steeply, from about 3 per cent in October, 1962, to about 2 per cent in April, 1963; a plateau occurred between January to March, 1963, at a nitrogen level of about 2.5 per cent.

During the recent 1963-64 season the fall in leaf nitrogen was mainly linear. However, nitrogen levels were slightly higher than in 1961-62 season.

Phosphorus levels showed not much seasonal variation; though considerable from site to site, largely dependent on soil phosphorus availability.

Potassium levels showed a similar effect to that of nitrogen, in that levels were slightly lower in the 1962-63 season. There were considerable variations in leaf potassium contents from site to site, largely dependent on the relative availability of potassium from the soil.

Soil analyses of exchangeable nutrients such as potassium, sodium, calcium and magnesium, when converted into terms of milligram equivalents per 100 gram of soil, have been expressed as a percentage of the sum of the latter elements; in other words as a percentage of the "S" value, defined as the cationic exchange capacity of a soil *excluding* the contribution from hydrogen.

A number of interesting features have been found, and relate to undesirable contributions from sodium, particularly at lower depths in the soil.

At one site the contribution of sodium at a depth of 3 feet was of the order of 30 per cent of the "S" value, and would affect adversely the crop growth were it not for presence of an impermeable layer below the top 12 inches of soil.

Where exchangeable sodium levels were high, exchangeable magnesium levels often were also high, the contribution of calcium falling proportionately. At some sites the contributions from magnesium at depths of 2 feet to 3 feet were higher than that from calcium, which on normal soils predominates over the sum of all other cations.

Undesirably high percentage contributions from sodium were not evident at M.I.A. peach sampling sites near the surface.

Iron contents of peach leaves on M.I.A. peach sampling sites were generally of the order of 100-150 p.p.m. of leaf dry matter.

Leaf copper levels were generally between 3-12 p.p.m. of dry matter, depending on location and soil type and whether or not copper sprays had been applied as a fungicide. Corresponding levels of exchangeable soil copper, using as the extractant the tetra ammonium salt of ethylene diamine tetra acetic acid, gave values of plant-available copper varying from 1-20 p.p.m. The lowest levels occurred in samples taken from light sandy soils.

It seems likely that leaf copper would be undesirably low on some sites were it not for the use of copper bordeaux sprays.

Zinc levels varied from less than 20 p.p.m. to 60 p.p.m. of dry matter. Zinc levels were assessed sub-optimal at a number of sites and growers would be advised to use some zinc sulphate in their bordeaux sprays.

Boron levels of peach leaves taken from the M.I.A. peach sampling sites were in the region 20-80 p.p.m. of dry matter, depending on location and season. The corresponding levels for water extractable boron varied from 0.4 to 1.6 p.p.m. of air dry soil. Levels of less than 0.3 p.p.m. of water extractable boron in the soil are considered likely to cause boron deficiencies in crops. Consequently, since the water extractable boron was generally greater than 0.4 p.p.m. and since only a small minority of sites had levels around the marginal level of 200 p.p.m., boron deficiency is likely on the soil types so far investigated—except on some orchards in very dry seasons.

Manganese levels were of the order of less than 20 p.p.m. to 100 p.p.m. of leaf dry matter, dependent on site and location. Corresponding soil exchangeable manganese levels as determined by extraction with cobaltous nitrate were of the order 20 to 80 p.p.m. of air dry soil.

Leaf calcium and magnesium levels were generally satisfactory. Levels of calcium were usually of the order 1.5 per cent of dry matter in November and 2.5 per cent in March. Magnesium levels were of the order of 0.6 per cent in November and 1.0 per cent in March.

Sodium levels in the leaf were generally low and were in between 0.01 to 0.02 per cent of leaf dry matter. Leaf chloride levels expressed as per cent NaCl were of the order of 0.05 to 0.20 per cent of leaf dry matter and tended to be highest at the end of the season.

Problem Orchards.—Of 50 problem orchards visited during the three years period 1961-64, only one appeared to be suffering from acidity and straight-forward potassium magnesium deficiency. At this site the problem was located only in patches on a windblown sandy soil.

Many of the problem orchards were situated on poorly drained, poorly structured soils lacking in organic matter; frequently associated with sodium in the soil, inhibiting normal uptake of manganese or potassium by plant roots.

On about one-sixth of the total of problem orchards visited, there were sub-marginal levels of leaf manganese; associated with low-exchangeable soil manganese, high soil pH and high-exchangeable soil sodium. At many of these sites there was need of ½ to 1 ton of gypsum/acre, per 6 inch furrow slice, to help displace undesirable levels of soil sodium.

On some problem orchards a response could be expected to foliar sprays of manganese, zinc or copper.

On a number of newly planted orchards, on light sandy soils, levels of available copper in the soil were well below the level of 1 p.p.m. considered by many authorities as near the level whereat crops could suffer from copper deficiency.

On some orchards on light sandy soils, cropped for a number of years, levels of available copper in the top 6" of soil are high enough to suggest that copper accumulation has occurred from repeated use of copper fungicides.

Lectures and Demonstrations.—Lectures relating to nutrition of fruit trees were given at growers' meetings. "Peach Nutrition in the M.I.A." was subject of a lecture to the Riverina Branch of the Australian Society of Soil Science. "Soils in the M.I.A." subject matter was lectured on and demonstrated to students in the Farm Certificate Course, Yanco Agricultural Research Station.

Botany Branch

NATIONAL HERBARIUM, ROYAL BOTANIC GARDENS AND ALLIED ACTIVITIES

National Herbarium

Staff.—Mr. R. H. Anderson retired from the Public Service on 12th March, 1964, after 43 years of continuous duty. Mr. Anderson joined the Department as Assistant Botanist, and rose to the position of Chief Botanist in 1936 and, later, Director and Chief Botanist, Royal Botanic Gardens and National Herbarium. Under his direction the Botany Branch of the Department and the Royal Botanic Gardens have been developed to a standard which is highly regarded throughout the scientific world.

Mr. K. Mair took up duties as Director and Chief Botanist following the retirement of Mr. R. H. Anderson.

Dr. Joyce W. Vickery has been appointed to the position of Senior Botanist.

Mr. A. McIndoe, a man with a vast knowledge of horticulture and garden plants, resigned from the position of Botanical Assistant in August on account of ill-health. With deep regret it is necessary to record his death in November, 1963.

Degrees and Awards.—Miss Mary D. Tindale was awarded the degree of Doctor of Science by the University of Sydney for a thesis entitled "Taxonomic Studies in the Ferns, Fern-Allies and *Acacia*". The W. B. Clarke Medal for 1964 was presented by the Royal Society of New South Wales to Dr. Joyce W. Vickery.

Two botanists were abroad, one as Liaison Officer at Kew, the other on a research scholarship in the U.S.A. Each has now resumed normal duties. The position of botanical assistant was also vacant for most of the year. All routine duties were carried out but research investigations were curtailed by the absences.

Botanical Research and Publications.—Vol. 3 No. 4 of *Contributions from the New South Wales National Herbarium*, containing eleven research papers, was published.

Two parts of the *Contributions from the New South Wales National Herbarium*, Flora Series, have been published, viz. "No. 201, Hymenophyllaceae" by Mary D. Tindale, and "No. 136, Flacourtiaceae" by H. Sleumer.

A "Monograph of the Genus Lastreopsis" by Mary D. Tindale has been completed and submitted for printing in *Contributions from the New South Wales National Herbarium*, Vol. 3, No. 5.

Two papers, "Supplement to the Key to the Genera of Rhodophyceae (Red Algae) Hitherto Recorded from Australia" and "A Census and Key to the Species of Rhodophyceae (Red Algae) recorded from Australia" by Valerie May (Mrs. E. H. Jones) are almost complete and will shortly be submitted for publication.

A paper by Alma T. Lee on the genus *Xanthorrhoea* and the treatment of the family Xanthorrhoeaceae for *The Flora of New South Wales* are nearing completion.

For *The Flora of New South Wales* preparation of material on the families Restionaceae, Centrolepidaceae, Xyridaceae, Eriocaulaceae, Commelinaceae and Philydraceae by O. D. Evans, partly in association with L. A. S. Johnson, is also nearing completion. A paper on *Xyris gracilis* is being prepared.

Further investigations have been carried out on the *Acacia decurrens* group of Wattles.

Delimitations of genera in the Aspidiaceae, a family of ferns have been studied.

Research into the genera *Juncus*, *Casuarina*, *Eucalyptus*, *Poa* and *Ranunculus*, and the family Proteaceae has progressed.

Cytological Studies.—These have mostly been concerned with groups under investigation for *The Flora of New South Wales.*

Chromosome counts have been made on five species of *Acacia*, several species of the ferns *Marsilea* and *Lastreopsis*, species of *Eriocaulon, Centrolepis, Philydrum, Helmholtzia, Blandfordia, Doryanthes*, on four native and three introduced species of the Commelinaceae, and on *Xyris*. All five species of *Xyris* native in New South Wales were investigated.

In *Lomandra* a considerable range of chromosome numbers has been demonstrated. There is evidence of variability in chromosome number within several of the species.

Information is also being gathered on some of the numerous Australian species of Cyperaceae.

Studies on Proteaceae were continued with material of *Franklandia* and *Kermadecia*. This work provided the first information on chromosome numbers in these genera.

Overseas Investigations.—Botanist Mr. L. A. S. Johnson returned in mid-December after 15 months as Australian Liaison Botanical Officer at the Herbarium, Royal Botanic Gardens, Kew, England. At Kew and the British Museum (Natural History) he studied many type specimens of Australian plants and pursued his researches on the families Casuarinaceae, Juncaceae, Proteaceae and other groups. Mr. Johnson also visited Botanic Gardens, Herbaria, and Universities in many centres in other parts of Britain, U.S.A., Canada, France, Belgium, Holland, Denmark, Sweden, U.S.S.R., Czechoslovakia, Austria and Singapore. In addition he attended congresses at Montreal and Aberystwyth and the International Genetical Congress at The Hague. He established useful contacts with botanists in all these centres.

Botanist Dr. Barbara Briggs returned to the Herbarium in October after 15 months leave abroad. She spent most of this period at the University of California at Berkeley, on a C.S.I.R.O. Overseas Post-graduate Studentship. Subsequently Dr. Briggs visited other Universities and Herbaria in America, at Boulder, Chicago, Washington, Cornell, Boston and New York, also the Herbarium and cytological laboratories of the Royal Botanic Gardens, Kew, England, the Universities of Cambridge, Leicester and Liverpool, the Herbaria at Paris, Vienna and Leiden, and the cytological Laboratories of the U.S.S.R. Academy of Sciences at Leningrad. Dr. Briggs presented at the XIth International Genetics Congress at Scheiveningen, Holland, a paper giving results of work on the Australian genus *Darwinia*.

Field Investigations.—Botanists' field work included visits to Cowra, Grenfell, Rankin Springs, Goolgowi, Leeton, Narrandera, Junee, Young and Blue Mountains districts to study in their native habitats trees and shrubs of *Acacia paucijuga* and *A. deanei*, two species of the *A. decurrens* group which are very similar in general appearance. Collections of *Acacia, Pultenaea, Dillwynia, Juncus*, grasses and composites were also made.

The *Pultenaea canescens* group was studied in the Clarence, Bathurst and other localities to examine the variation in the populations.

Near Glenfield the fruiting material of *Marsilea mutica* and the rare *M. hirsuta* were examined. Living plants, sporocarps and herbarium material were collected both for the National Herbarium, Sydney, and for other institutions.

At Mt. Franklin, *Acacia dealbata* and its high altitude form were studied. Herbarium and cytological material were collected from trees at various altitudes.

The rain forest at Iluka and Woody Head, north of the Clarence River estuary, was visited. Several rare species were observed.

At Mt. Gingera, observations were made on the species of *Poa* in this high altitude region. Most of the previous studies of these species had been made on the Kosciusko Plateau. The various species at and en route to Mt. Gingera were found to correlate well with those observed earlier in comparable altitude regions on the Kosciusko Plateau and elsewhere.

The Happy Jacks and Kosciusko regions were visited for observations on plant regeneration in the disturbed areas. This was needed because of enquiries at the Herbarium regarding the effects, on the native vegetation of this district, of the planting of alien species for soil conservation purposes. Observations were made at various altitudes. Although many sites are not yet in a satisfactory condition a pleasing grass cover was noted at many disturbed sites and at some of them an early tendency to invasion by native shrubs.

The West Head area in Kuringai Chase was visited at the request of the Superintendent, to advise on preservation of rare native species threatened by roadworks.

Members of the staff also escorted Dr. P. A. Munz of the Rancho Santa Ana Botanic Garden, Claremont, Cal., U.S.A., on field trips to the Blue Mountains, and sandstone and sandhill areas of the metropolitan coastal district.

Plant Species New to New South Wales.—The following species were recorded for the first time within the State:—

Calochilus saprophyticus (family Orchidaceae) from the Olney State Forest. Reputedly flowering beneath the soil surface, on this occasion it was uncovered at the edge of a sawdust heap.

Drymaria cordata (family Caryophyllaceae) from Murwillumbah and reported to be a weed in gardens; not previously collected in New South Wales, although native in Northern Queensland, several of the Pacific Islands and in tropical areas of Asia and America.

Cenchrus calyculatus (family Gramineae) from Kyogle and Lismore districts and reported to be invading kikuyu and paspalum pastures; native to Fiji and other Pacific Islands.

Diplotaxis tenuifolia (family Cruciferae), "Sand Rocket", from Deniliquin, said to be a common weed in railway yards; the first record of the species in New South Wales though it is known in South Australia; a European crucifer related to *Brassica*, it could be a weed of cultivated land, though probably not a serious one.

Thunbergia alata (family Acanthaceae) from North Epping where it has become established and apparently naturalised; invading slightly disturbed scrub undergrowth on sandstone; commonly in gardens as an ornamental climber.

Amaranthus muricatus (family Amaranthaceae), a native of South America, has become naturalised at Urana.

Juncus microcephalus (family Juncaceae) from Merewether, near Newcastle; an introduction from South or Central America; not hitherto been found in this State, though established near Albany in Western Australia; a soft rush in roadside ditches, etc.; not likely to become a serious pest. A small-flowered species of *Oenothera* (family Onagraceae) has become naturalised in a number of localities on the Northern Tablelands and in coastal districts of New South Wales has now been identified as *Oenothera indecora*, a native of South America.

Correct Identifications.—A specimen collected some 50 years ago in the Bourke district has been identified as *Grevillea albiflora* (family Proteaceae), a species hitherto known only from north-east Queensland. Subsequently, a specimen collected in 1962 from 100 miles north-east of Bourke was found to be this rare species. These had previously been regarded as two other species which when in fruit superficially resemble *G. albiflora*.

A new record, for N.S.W., has been established for *Grevillea polybractea*. The specimens were collected a few years ago at Wymah, east of Albury. This is a small species described from northern Victoria. It is related to *G. floribunda* which is found from Wagga northwards. An early record of *G. polybractea* from the Dubbo district is unconfirmed, and doubtful on distributional grounds.

A specimen collected some 50 years ago in the Sandilands Range, Richmond River district, and mis-identified at the time, has been found to be *Carex hubbardii* (family Cyperaceae), species formerly known only from southern Queensland. It is a tussocky sedge related to *Carex longibrachiata*, "Bergalia Tussock", which is often a weed of moist pastures. There is no evidence that *C. hubbardii* is likely to become a weed problem.

Extensions of Range.—The following species were found in regions beyond their previously known limits within the State or adjacent districts:—

Pterostylis truncata has been collected at Bergalia, providing a link between its previously known occurrences in the Hunter Valley and in Victoria.

Pterostylis nana has been found at Warragery, west of its previously known range, and also been reported as in the Wellington district.

Pterostylis concinna is now recorded from near Wellington, west of its known occurrence on the coast and the tablelands.

Xyris operculata, X. gracilis and *X. juncea* have been collected on the coastal tableland behind Austinmer, a connecting link between their coastal and tableland occurrences; *X. juncea* has also been obtained from Howes Valley.

Xyris complanata has been collected near Kurnell, whereas the most southerly record was previously Narrabeen Lakes.

The rarely collected *Pultenaea echinula* was found to occur in patches on the King's Tableland, Blue Mountains.

Caladenia dilatata var. *concinna,* a rare variety, was sent in from Eugowra.

A specimen of the small annual naturalised grass *Sclerochloa dura* was received from the Cooma district; previously the only record of it in New South Wales was at Goulburn. It is a native of Europe and Northern Africa, and unlikely to be of economic importance.

Lepyrodia leptocaulis has been obtained near Ulan in the upper Goulburn River district, north-north-east of Mudgee; previously recorded only from Inverell and Torrington in New South Wales and Stanthorpe in Queensland.

Murdannia graminea has been obtained from Uarbry, east of Dunedoo, its first record on the central western slopes.

Schoenus nitens has been obtained from the Myall Lakes. This rarely collected native sedge has previously been known in this State only from two localities, on central coast and southern tablelands.

A specimen of a grass believed to be *Paspalum ciliatifolium,* a native of the southern half of the U.S.A., has been received from the Grafton district. It was growing in a creek bed on light sandy loam. Only one previous specimen has been received, from Brockhurst near Macksville, in 1912.

A collection from Yerranderie has been determined as *Eucalyptus baeuerlenii,* a species hitherto known only from two localities, Wentworth Falls and Braidwood. This is a most interesting discovery since other localities for the species have been sought unsuccessfully by many observers over the last half-century.

A specimen of *Acacia lucasii* from the Nunniong Plateau, East Gippsland, provides the first record of this species from Victoria. Previously, it had been found only in the Tuross district and the Tinderry mountains in New South Wales.

Neolitsea dealbata, a small rainforest tree common on the north coast, has been found at Mt. Keira near Wollongong; previously not definitely known to occur south of Gosford.

Dendrobium striolatum is now recorded as occurring east of Rylstone, a westerly extension of its former known range.

Special Identifications.—From amongst the many plants submitted for identification and report, certain special identifications by members of the botanical staff are worthy of note.

Two plant specimens were examined for the Chatswood police, in relation to a serious case of assault, to ascertain whether they had any connection with drug-taking habits. Other plant specimens were examined for the Criminal Investigation Bureau in connection with a case of "breaking, entering, theft".

Large collections of *Lastreopsis* were identified for the herbaria at Kew, Paris, Brussels and Harvard.

A collection of ferns from Lord Howe Island was identified for the Arnold Arboretum, Jamaica Plain, U.S.A. Another collection of ferns, made by Dr. R. Hoogland, was identified for the C.S.I.R.O. Division of Land Research and Regional Survey.

A rare fern, *Monogramma dareicarpa* (family Vittariaceae), was received from the Palmerston Highway, north-east Queensland, and identified. According to our herbarium records it was last collected in 1910.

Thirty specimens of the family Papilonaceae, collected in Western Queensland, were determined for Professor N. C. W. Beadle, to assist in his work on nodulation of legumes.

Specimens of the *Acacia decurrens* group in the herbarium of the C.S.I.R.O. Division of Plant Industry were examined and identified.

Large collections of miscellaneous specimens have been determined for the Parks and Gardens Section, Department of the Interior, Canberra, the C.S.I.R.O., Canberra, and the University of New South Wales.

The annual herb *Calocephalus sonderi* was identified as an impurity in wheat from the Oaklands district. This native species, like many members of the family Compositae, is somewhat aromatic and has caused the rejection of some loads of wheat.

Exchanges and Loans with Other Institutions.—Some 750 sheets of herbarium specimens were forwarded to 13 overseas and five Australian institutions. The specimens covered the full range of species obtained by the botanical collector, and a number of specially requested groups such as Australian lichens and members of the families Restionaceae and Araceae.

In exchange, about 2,750 sheets of herbarium specimens were received from nine overseas and four Australian institutions. These included special collections of *Juncus,* lichens, orchids, ferns and poisonous legumes, and some holotype specimens of *Geranium* and *Wahlenbergia* species.

Seed of selected species of the Malvales and Styracaceae were provided for the C.S.I.R.O. Division of Food Preservation, for work on biological effects of ingestion of oils from plants of these groups.

Specimens were forwarded on loan to a number of institutions where botanists were studying particular groups. These included material of *Gossypium sturtianum* to the Cotton Research Centre, Tempe, Arizona; *Nypa* to the Rijksmuseets Palaeobotaniska Avdelning, Stockholm; *Salvia verbenaca* and related forms to the Royal Botanic Garden, Edinburgh; selected specimens of the family Monimiaceae to the C.S.I.R.O. Division of Land Research and Regional Survey, Canberra; *Myriophyllum* to the University of New England; *Eriostemon, Crowea* and *Phebalium* to the State Herbarium of South Australia.

Field Collections and Seed Exchange.—The Botanical Collector spent 84½ days in the field and travelled 8,543 miles. Nine and a half days comprised single or part-day collecting. The other 75 days were occupied on eight collecting trips of from two to 22 days duration.

In all, 650 numbers of herbarium specimens were collected for study and exchange, 110 lots of seed in bulk were collected in country areas and 100 lots from the Royal Botanic Gardens, for exchange purposes.

This year again much of the collector's time was taken up in searching for specific material required by the botanists for study towards compilation of data for *The Flora of New South Wales* and for cytological studies. The additional data obtained proved very valuable.

Specific floral and vegetable material were collected for forwarding by air in response to special requests by overseas botanists. The material included: living plants of *Marsilea* to India and France, and *Macroglena caudata* to the Royal Botanic Gardens, Kew; preserved material of *Synoum glandulosum* to Oxford University and of three members of the family Rutaceae to Andhra University, India; seed of *Iseilema membranaceum* to the University of Saugar, India, for cytological study; and a selection of wildflowers for exhibition at Alice Springs.

In exchanges, about 190 samples of seed or living plants were received, from some 25 overseas and Australian institutions, 2,330 packets of seed were despatched to 280 institutions. Seed of a number of plants of interest for cultivation in the Gardens were brought in by members of the botanical staff.

Visitors to the Herbarium.—Overseas visitors who worked at the Herbarium and inspected the Botanic Gardens this year included: Professor M. A. Johnson, Rutgers University, New Brunswick, U.S.A.; Mr. Green, Honolulu Botanic Gardens, Hawaii; Professor R. E. Holtthum, a world authority on ferns and orchids, who studied the Australian species of *Cyathea*; Dr. Mary Pocock, Rhodes University, South Africa, a specialist on sea-weeds; Mr. D. Sayers, Royal Botanic Gardens, Kew; Dr. R. Howard, Director of the Arnold Arboretum, Jamaica Plain, Mass., U.S.A.; Mr. P. Green, also of the Arnold Arboretum; Dr. G. Cooley, Gray Herbarium, Cambridge, U.S.A.; Dr. Hugo Boyko, Ecological Adviser to the World Academy of Arts and Science, interested in salt-water irrigation on sandy soils; Dr. H. U. Stauffer, University of Zurich, Switzerland, who studied Australian members of the family Santalaceae; Dr. H. Moore jnr., Bailey Hortorium, Ithaca, N.Y., U.S.A., who studied the Palmaceae; Princess Chumbot and Princess Sonakul of Thailand; Dr. Fernandez Perez, Herbario Nacional de Colombia, Bogota, a specialist on the family Lentibulariaceae; Dr. P. A. Munz, Rancho Santa Ana Botanic Garden, Claremont, Cal., U.S.A., a specialist on *Oenothera* and other genera of the Onagraceae; Mr. A. Haseltine, past President of the New Zealand Nurserymen's Association.

Many Australian botanists also visited the Herbarium.

General.—An artist for *Readers Digest* was granted facilities for two weeks whilst preparing paintings of Australian wildflowers for a book cover.

Life magazine selected 24 transparencies from the Herbarium ollection of colour slides for inspection in the U.S.A., relative o publication of a book on Australian fauna and flora.

An exhibit of publications, drawings and living plants illusrating aspects of plant classification was prepared and staffed by the botanical staff for a conversazione held by the Linnean Society of New South Wales at the University of Sydney.

On two occasions expert evidence was given at the request of the solicitor for Hornsby Shire Council on the scientific mportance of bushland reserves and the probable effects upon hem of certain kinds of industrial and residential development.

Services to outside organisations included lectures to Landcape Architects, at the University of New South Wales; to he Garden Club of Australia, on Poison Plants; to the Randwick Historical Society, on the Royal Botanic Gardens and National Herbarium in relation to the History of the Colony; to the Blackheath Presbyterian Fellowship, on Plant Collecting; to the Blackheath Rotary Club, to the Blackheath Horticultural Society, to the Jewish Ladies' Association, on Wild Flower Collecting; to the Leura Garden Club, on "Acacias" of Australia; to the Katoomba Methodist P.S.A., on Plant Collecting; and to the Bathurst Field Naturalists' Society, on "Acacias" in Australia.

The Director and members of the staff served in a number of organisations or committees, including the Royal Botanic Gardens and Government Domain Trust, the Muogamarra Trust, the Linnean Society of New South Wales, the Remembrance Driveway Committee, the Horticultural Advisory Committee of the Department of Technical Education, and the Centennial Park Advisory Committee.

Royal Botanic Gardens

General Improvements.—Restoration of areas in the Royal Botanic Gardens and Domains affected by construction of the Cahill Expressway has reached the stage where the constructing authorities have been relieved of all but minor responsibilities. Landscaping and replanting of areas which are the direct responsibility of this Branch have been delayed by secondment of the Landscape Designer to the position of Superintendent, Centennial Park. Despite the delay in replanting these areas the standard of general maintenance has occasioned favourable comment and increased public interest. Improvements this year have included the following.

A new main entrance was constructed on Mrs. Macquarie's Road adjacent to the Art Gallery and opened on Anzac Day. Formation of pathways to link this entrance with the existing system of pathways in the Upper Garden, and realignment, coping and resurfacing of these and associated pathways in the Middle Garden, were completed by contract. The related regrading of adjacent lawn areas and the widening of grass verges are well advanced.

A raised plantation area has been formed between the Cahill Expressway and the private access road to the Depot. Turf, on the embankment so formed, and a screen planting of *Callistemon shiressii*, have been established.

The old border of Australian native plants in the N.E. area of the Gardens has been reconstructed. For years this needed attention. Considerable labour and money have been expended on realignment, construction of low stone retaining wall, and re-soiling. Special consideration has been given to expansion of the native plants and more than 100 native species have been obtained and propagated for later planting. When the area is well established it will be an outstanding feature.

In the Middle Garden the second stage of a three-stage programme of storm-water drainage renewal has been completed. This involved further replacement of the original system of stone slab drains and brought to 900 feet the total of reinforced concrete piping laid in this section.

Old superfluous trees have been replaced by new introductions of some 150 species and varieties, including several not previously represented.

A number of isolated garden-beds used for floral bedding have been eliminated, and several shrubberies have been remodelled to provide better background for floral displays. Progress has been made by introducing somewhat different floral effects in beds and borders with new and improved varieties and strains.

Additions have been made to the new turf grass plots constructed last year to replace the old demonstration area of turfs. These turf plots are continuing to attract considerable public interest.

Coping has been provided for the surrounds of a number of shrubberies, including: the Magnolia section, the large shrubbery immediately to the west of the palm section in the Middle Garden, and the southern end of the plantation borders of the middle garden.

About 30,000 square feet of grass has been established in areas previously denuded of turf by shade, erosion and concentrated traffic; and about 15,000 square feet of established Lawn area has been regarded to improve general appearance of the Gardens.

Lirope borders throughout the Palm section have been reformed and the planting of Clivia hybrids has been extended.

More than 500 cubic yards of silt, the balance of a considerably larger quantity dredged from the ponds in 1960-61 and stockpiled in the Lower Garden, was transported and used in restoration and improvement of various areas within the Gardens. Restoration of the lawn-area affected by storage has started.

The Nursery.—The major objective, increased range and quantity of production in the nursery, has been achieved. At 30th June, 1964, it contained about 8,000 plants representing 1,500 species and varieties. Of these, over 200 were introduced this year by exchange with other overseas institutions and a further 200 were introductions from local sources.

The nursery also raises about 50,000 seedlings twice yearly for seasonal, floral bedding displays.

Relative values of various understocks for certain of the Coniferae are being tested, in the course of expanded budding and grafting operations.

Improvements in the area included provision of the first of two shade houses, constructed of pipe frame with plastic shade cloth. A second, smaller house is partly completed.

The Glasshouses.—Many effective displays of foliage plants, ferns and flowering plants were staged, despite difficulties arising from the deteriorating general condition of the houses.

Plants were provided to decorate official rooms of the Royal Agricultural Society at the Easter Show. Supply of foliage plants to Government office buildings has been maintained as previously.

Now that requests for displays of foliage plants in Government offices has increased considerably, arrangements are being made elsewhere to provide a suitable service and this Branch is providing guidance.

Construction of the large aluminium glasshouse, to replace the house used for public displays and demolished in 1962, is still incomplete.

Landscape Designing.—The Landscape Designer's activities have been almost entirely confined to close supervision of the work associated with restoration of areas affected by construction of the Cahill Expressway. Therefore, many requests for advice on garden design and shrub and tree planting could not be met. The Landscape Designer did undertake four country visits, however, as follows: to Inverell, to inspect a park site and report on suggested development to McIntyre Shire Council; to Wollongong, to inspect the Teachers' College relative to landscaping the first section of grounds; to Wagga, to examine the Wagga Agricultural College and Wagga Teachers' College sites, preliminary to landscape planning; to Wangi, to advise on windbreak planting for the power station.

In the County of Cumberland, plans and reports were completed for the landscaping of Greystanes High School and Blacktown Secondary School. Picnic Point Public School was advised on tree planting. Improvements and specifications in relation to tree planting at Mona Vale Hospital were prepared for Public Works Department. Hunters Hill Council was advised in regard to screening an industrial development in the municipality. Vaucluse House Trust was advised relative to landscaping.

The Landscape Designer adjudicated in the Windsor District Garden Competition and the Willoughby Section of the *Herald* Garden Competition. He also lectured on landscape gardening to the Lower Portland Agricultural Bureau.

General.—In July, 1963, a true pair of black swans was presented by the City of Perth and handed over by the Western Australian Minister for Industrial Development.

A fountain donated by the Crippled Children's Association, with a motif and pool designed by Professor P. Spooner, was opened on the patio entrance to the Palace Gardens in Macquarie Street.

The Domains

The area was satisfactorily maintained. Some improvements included: resurfacing of the pathway parallel with the western side of Wooloomooloo Bay, from Mrs. Macquarie's Point to the Domain Baths; planting of trees, mainly *Eucalyptus* spp., in the area between the Garden's boundary and Mrs. Macquarie's Point; and erection, by the Sydney County Council, of new light standards on the eastern side of Art Gallery Road.

Playing fields were again in heavy demand by sporting bodies. By relocating the Soccer football field, a full-sized Rugby League field was provided. This followed complete restoration of areas affected by the Expressway constructions. Drainage to intercept seepage from higher ground is needed. This will be provided during the coming year.

Progress restoration of areas affected by the Domain Parking Station has been disappointingly slow. Conferences with the City Council officers have led to a construction plan. With slight modification this should enable the necessary work to proceed.

Condition of some extensive grass areas affected by construction of the Cahill Expressway has not been satisfactorily restored. Further negotiations with the Council may be needed.

A limited area of the Domain was again made available for parking Christmas shoppers' cars; also during the one-day bus strikes in February and March.

The Domain was again used for parades and assembly point for various processions. An area near Farm Cove was made available for the Dedication Ceremony of the Krait Memorial.

The condition of many once-majestic fig trees further deteriorated. Some will be removed for public safety.

Admiralty House and Government House

Some pleasing improvements were made to both places. Extensive floral displays have been established. Special attention is being given to maintenance and improvement of lawn areas, to coincide with a forthcoming Royal visit.

Centennial Park

Strong public criticism followed when in 1963 the development of a further area of Centennial Park for specialised sporting activities was suggested. Since then, a re-organisation of the personnel establishment and provision of additional equipment have been determined. Early in 1964, a Superintendent was appointed, replacing the recently-retired overseer; also an additional foreman and four garden labourers. Extra equipment included two new tractors (replacing worn-out machines), a 10-foot tractor-operated rotary slasher, a 24-inch rotary hoe, a tractor-operated rear-end grader blade and three 30-inch self-propelled rotary mowers. In consequence, the previously unkept grassland and hillside areas were cleared of accumulated overgrowth by the end of the financial year. Much of the manual work was accomplished by employing up to fourteen casual labourers for some weeks.

The Centennial Park Supervisory Committee, comprising senior inter-departmental officers, was brought into being in May, 1964. This Committee has formulated schemes for restoration and development of Centennial Park and the contiguous Queen's Park area. Action is under way to obtain the services of tradesmen and further garden labourers, in preparation for the anticipated large-scale developmental work.

Members of the public have recently recorded their appreciation of the close attention being given to Centennial Park by the Department.

AGRICULTURAL RESEARCH INSTITUTE
WAGGA WAGGA

General

Tenth Anniversary.—The tenth anniversary of foundation of the Institute was commemorated by a "Science in Agriculture" week in July, 1963. Highlights included displays of research exhibits, and demonstrations designed for secondary school pupils, illustrating how basic sciences are applied to the solution of farm problems. The Wagga Wagga Historical Society co-operated with the Institute in displaying historical documents and farm machinery relating to the early agricultural development of southern New South Wales.

Expanded Facilities.—Wheat Industry Research Funds supplemented a Treasury grant for extension of the Institute's laboratories. The new facilities will help in meeting the increasing demands made on the Institute resources. For example, this year new programmes were commenced in the central west and in the Murrumbidgee Irrigation Area, and currently an extension of the Institute's animal husbandry programme in the Tumbarumba area is under consideration.

Director's Overseas Visit.—Director of the Institute, Dr. A. T. Pugsley, visited agricultural research centres in North America, Europe and East Africa, and also attended International Meetings in Sweden and The Netherlands. In this way new advances being made overseas may be readily and directly applied to relevant problems in New South Wales.

New Germ Plasm from Overseas.—Significant contributions have recently been made through introduction of new germ plasm from research centres overseas. Plant breeding programmes of the future must be based on such introduction. Thus it is important that effective liaison be maintained.

Wheat Improvement

Record Wheat Production and Yields Helped by New Varieties.—Record production and record mean yields were a feature of the 1963-64 wheat year in New South Wales. Widespread farmer adoption of new varieties originating from the Institute has contributed to this increased production.

When the statistical records become available it is anticipated that, for the first time in 40 years, a Departmental variety (Heron) will be noted in first place in acreage for the State. Heron was released in 1958. It continues to gain in popularity not only in New South Wales but throughout the remaining wheat areas of the Commonwealth.

Falcon, released in 1960, has also been widely acclaimed as a high yielding variety of superior baking quality. Its ability to maintain good baking characteristics at relatively low protein levels is a pleasing feature.

Advanced Crossbreds.—Routine evaluation trials from the past season supported earlier results indicating that an improved strain of Heron (previously known as KF Heron) may be worthy of release. The new strain has additional resistance to stem rust (Sr_9 gene) and is slightly earlier in maturity. Two backcross derivatives of Heron, possessing additional resistance to loose smut and stem rust respectively, have been combined in a single strain. This is currently being evaluated prior to release.

An extension programme to incorporate superior baking quality in a Glenwari background has been completed. Although all ten lines of Gabo x three Glenwari possess the desired quality and yield as well as or better than Glenwari, they have had to be discarded. All lines possess "hard" characteristics now considered undesirable for much of the wheat belt. The higher yield ceilings of Heron and Olympic now demand an increment over and above the Glenwari standard.

Quality improvement work is now based on Heron and some attention has been directed to the quality characteristics of new semi-dwarf material.

Studies on the inheritance of granularity as measured by the Particle Size Index have been carried to a further stage.

Semi-dwarf Wheats.—Previously reported studies of newly introduced semi-dwarf crossbreds have been extended. These together with locally produced crossbreds have yielded particularly well. A Norin 10-Brevor 14 back-cross derivative of Javelin 48 is the most advanced of the local productions. This crossbred (N.B.J. 115) distinguished itself in the 1963 trials at Temora Agricultural Research Station by returning a mean yield of 80.0 bushels per acre, the highest figure yet achieved in such trials.

Related Significance of Expanded Wheat Irrigation.—With the opening up of new areas the acreage of irrigated wheat in south-western New South Wales now approaches 150,000 acres. Shortages of straw and resistance to Australian races of stem rust are essential requirements of varieties for irrigation. Such qualities characterise many of the introductions from the Latin America programme of the Rockefeller Foundation. Extensive yield trials have been established in the Murrumbidgee Irrigation Area where special attention will be directed to the suitability of this material for either bread or biscuit manufacture.

Associated plant physiology studies of factors influencing ant height have been continued, with particular reference the role of Gibberellin and related compounds.

Phasic Development.—Earlier work on the genetics and hysiology of growth and development in wheat have been xtended and steps taken to provide a greater control of nvironment for this work.

A world-wide survey has led to the assemblage of a epresentative range of varieties differing in their responses vernalization and photoperiod treatments. A genetic nalysis is being made of the differential behaviour of this material and paired isogenic lines are being developed for urther studies.

Of considerable interest has been the demonstration that cold requirements of varieties like Insignia 49 may be met uring the normal ripening process, provided this takes place uring the colder months of the year.

A winter strain of Raven has been developed and seed ocks are being increased to permit further evaluation. Such variety would be adapted to a wide range of sowing times nd fill a real need throughout the wheat belt.

Cytogenetics.—Further to the return of an officer from verseas a new programme in Cytogenetics has been aunched. The objective is incorporation, in the bread wheats, of germ plasm from related species and genera. Specialised techniques involving hybridisation, coupled with detailed cytological studies of chromosome number and behaviour, are being used.

A full series of 21 monosomic lines for each of the varieties Heron and Falcon has reached the second and hird back-cross stages respectively. The monosomic condition for each set of lines was originally derived from he monosomic series in the variety Chinese Spring. Monosomic lines so developed are expected to form the basis for the evaluation of intervarietal chromosome substitution as a breeding technique.

Fertile hybrids between wheat and rye (Secale) and Agropyron have been produced by means of colchicine treatment. From such hybrids it is hoped to extract lines of Heron carrying additional single chromosomes from the alien species. Particular attention is being given to the reaction of this material to take-all (*Ophiobolus graminis*) to which rye is highly resistant.

Chromosome Stability and Varietal Purity.—The genetic basis of failure of chromosome pairing in common wheat is being studied. Such failure is reflected in the appearance of "off-types" in populations of standard varieties. This work is basic to sound seed production programmes.

Wheat Quality Investigations

Testing Breeders' Material.—Routine milling and baking-quality testing of all material from the wheat breeding programme has enabled the early detection and elimination, in the reduced number of lines finally carried to advanced trials, of those lines with undesirable baking characteristics.

Ability to retain reasonable baking quality in the lower protein range—a characteristic most marked in the variety Falcon—is sought in the new crossbred wheats. This necessitates additional testing at low protein levels but at the same time provides another means of elimination.

A micro mill which has been installed recently will be used in conjunction with a micro-baking technique to eliminate undesirable material one year earlier than has been possible with the existing equipment.

Flour Particle Size and Quality.—Work on the distribution of flour particle size in relation to baking characteristics has been continued in an attempt to find differences which might account for the range of baking quality within the hard group of wheats. This work has failed to show any significant differences amongst the particle sizes separated by available sieves. The very fine particle range is now being investigated by means of sedimentation techniques.

Components of Flour Quality.—A long-term study of individual components of flour quality has been made in conjunction with routine quality testing. It is nearing completion. This work has provided a simple explanation for many differences, in both baking quality and physical dough properties, amongst the major wheat types. It has enabled the experimental elimination of these differences by relatively simple modifications of the major flour constituents.

Nitrogen Metabolism and Other Studies.—Studies on the nitrogen metabolism of Australian wheat varieties, and a series of investigations dealing with the diastatic activity and grain consistency of Australian wheat, have been concluded.

The preliminary findings on nitrogen metabolism were presented to a recent meeting of the Royal Australian Chemical Institute. The diastatic activity work has recently been published in *Nature*.

An improved technique for determination of total nitrogen in feed stuffs has been published in *The Analyst*.

Oat Improvement

Variety Improvements.—Cooba again proved to be the best dual purpose oat when sown early and grazed heavily. Because of its high grazing and grain yield, combined with early maturity and good grain quality, it has rapidly become the most popular oat variety in southern districts.

In tests under light grazing management the crossbred Fulmark x Ballidu x Dale x Fulghum exceeded all other varieties in fodder and grain production over the last two seasons. When grown for grain purposes this line equals the good performance of the grain variety Fulmark.

Root Studies.—Further studies on root development have shown that the root length and the number of roots per plant are significantly greater in good grazing oats compared with poorer varieties.

Ear Initiation and Growth Rate Studies.—All superior grazing oat varieties have a retarded ear initiation combined with a relatively slow early growth.

Several F_2 populations from varieties with a long vegetative phase crossed with oats having a short vegetative phase have been studied. Results indicate that it should be possible to readily combine a rapid early growth with good recovery after grazing.

Oats Identification Key.—A detailed description of oat varieties, including a key for their identification at various growth stages, has been completed and will shortly be published as a Science Bulletin.

Weed Investigations

Skeleton Weed.—Further studies on the relationship between environment and seed production allowed a more critical evaluation of the influence of photoperiod. In the absence of vernalization the critical photoperiod seems to be between 9 and 12 hours. At these daylengths floral induction is very slow, and light intensity and growth temperature influence rate of development.

Preliminary studies on regeneration confirm field observations that the rate of vegetative regeneration is retarded after the application of 2,4-D, as compared with the regenerative rate following cultivation. Application of 2,4-D seems to stimulate root development, at least temporarily, in undamaged roots.

In field trials with new herbicides Tordon gave 98 to 100 per cent control of skeleton weed at application rates of 1.4, 2.9 and 5.8 oz. a.e. per acre. In contrast, 2,4-D at 12 oz. a.e. and dicamba at 4, 8 and 12 oz. a.e. per acre gave only 60 per cent, and 30 per cent, 36 per cent and 55 per cent control respectively. Tordon, however, reduced tiller height and grain set of wheat at all application rates, and grain yield averaged only 20 per cent of the control's.

Quaternary Ammonium Compounds.—The response of capeweed (*Cryptostemma calendula*) and barley grass (*Hordeum leporinum*) to low application rates (1 to 4 oz. active cation per acre) have been confirmed. Time and volume of application, however, modified the results.

Both duquat and paraquat are toxic to Australian spring cereals but the response varies with time and rate of application. Spraying at the four leaf stage with 1 oz. a.c. per acre appears to be safe but later application and higher rates reduce yields considerably. Tolerance seems to be in the order: oats, wheat, barley; and paraquat is more damaging that diquat.

Pasture Husbandry

Pasture Utilisation.—A factorial trial examining three rates of stocking, 2, 4 and 6 dry ewes per acre, and four rates of superphosphate, 0, 1, 2 and 3 cwts. per acre, was commenced in 1962. The pasture, consisting of Wimmera ryegrass and subterranean clover, is grazed continuously without any special management refinements.

Greasy wool weights for 1962-63 are shown in the following table:—

Number of Sheep Per Acre	Rate of Superphosphate Per Acre Per Annum			
	0	1 cwt	2 cwt	3 cwt
2	10·6 lb.	11·6 lb.	11·5 lb.	11·2 lb.
4	10·0 lb.	10·6 lb.	9·8 lb.	10·0 lb.

Increase in stocking rate from 2 to 4 sheep per acre decreased wool production per head by an average of 1.2 lb. but increased production per acre by 18 lb. With a late break in the autumn of 1963 a grazing pressure of 6 sheep per acre was too severe on the newly germinated seedlings and the body weight of these sheep dropped to 65 lb. In 1964 when the autumn "break" occurred at a normal time the pasture supported 6 sheep per acre without undue stress. It may be noted from the foregoing table that wool production response to superphosphate was very slight.

The percentage of clover in the pasture, determined in May, 1964, is as follows:—

Number of Sheep Per Acre	Rate of Superphosphate Per Acre Per Annum			
	0	1 cwt	2 cwt	3 cwt
2	72%	35%	..	30%
4	78%	57%	46%	34%
6	62%	36%	36%	17%

At 6 sheep per acre the percentage of clover was lower than the 4 and 2 sheep treatments, due to the severe grazing pressure on the young clover seedlings at germination in 1963. At 4 sheep per acre the grazing pressure was sufficient to reduce the grass component, whereas 2 sheep per acre the pressure did not reduce the grasses. At all stocking rates, increased superphosphate has increased the grass component and reduced the percentage of clover in the pasture. It seems likely that these changes in composition may be responsible for the low wool-production response to superphosphate.

Soil measurements have so far indicated little change in total nitrogen or organic carbon but suggest that treatment-induced changes in incubation nitrogen and water soluble and aluminium phosphate fractions are occurring.

Pasture Oestrogens.—Sheep bio-assay (Allen-Doisy vaginal smear) of Dwalganup and Bacchus Marsh subterranean clover strains indicates that the Dwalganup variety possesses more oestrogenic activity than does Bacchus Marsh throughout the growing season. There appeared to be little change in activity (within strain) during the vegetative phase of growth but a marked fluctuation occurred during the reproductive phase.

The lambing percentage of ewes grazing (*a*) Dwalganup, (*b*) Bacchus Marsh and (*c*) lucerne-medic pastures for two weeks prior to and for six weeks during mating in October-November was 74, 90 and 93 per cent respectively. This indicated a marked depression in lambing percentage for the group mated on Dwalganup. The respective oestrogenic potency of the pastures (vaginal smear assay, intake per day stilboestrol) was 39.2, 7.0 and 5.0.

Crop Physiology

Earlier studies on the behaviour of wheat (variety Heron) have been continued with the following results.

(*a*) *Influence of Time of Sowing on Growth and Development.*—For each week's delay in sowing after the last week of April to mid August, there was 1½-2 days delay in flowering.

Cumulative evapotranspiration increased with early sowing at a given time, but at flowering there was little difference in available soil moisture under each crop. However, with higher potential evapotranspiration, post-flowering conditions were more severe for later sowings.

Grain yield was related to photosynthetic area duration after flowering. For 1961, 1962 and 1963 the grain yields were reduced by 2.6, 1.5 and 3.0 bushels per acre for each week's delay in sowing.

(*b*) *Sowing Rate Treatments.*—There was no significant effect on grain yield in 1961 for sowing rates ranging from 30 to 120 lb. per acre (7 in. rows) but in 1962 the grain yield was reduced by sowing at 120 lb. per acre.

Cumulative evapotranspiration differences at flowering between extreme sowing rates was about 65 points in each year.

Grain yields were related to photosythetic area duration after flowering. Plant moisture stress, as measured by leaf relative turgidity after flowering, was increased by heavier sowing rates and this was associated with an increased rate of senescence of photosythetic tissue.

Wide row spacing (21 in.) reduced cumulative evoptranspiration but potential yield at flowering was reduced as compared with normal 7 in. spacing at the same sowing rate.

(*c*) *Influence of Superphosphate and Nitrogen on Flowering.*—The data were small except where nil superphosphate delayed flowering 2-6 days.

In early spring 1962, significant evapotranspiration rate differences were correlated with photosynthetic area index differences. This resulted in differences of 2 in. of soil moisture between the densest and thinnest crops in October but this decreased to less than 1 in. at maturity.

Leaf relative turgidity at dawn showed a good relationship to estimated soil moisture stress. Photosynthetic area index at flowering and the senescence rate of this tissue were inversely related because of plant moisture stress.

(*d*) *Varietal Growth and Development as Related to Soil and Plant Moisture Stress.*—Preliminary work on the varietal aspects has been extended. Two new projects have been designed to increase understanding of the relation between the natural water regime and the growth of wheat and pasture plants. These projects comprise a study of drought resistance and a study of variation in the transpiration ratio of plants with various environmental factors.

Both projects require provision of shelter to enable the experimental work to be done in conditions approaching those of the open field as closely as possible except for exclusion of birds and rain.

The Drought Resistance Study.—This aims, in the first place, to establish a satisfactory method of assessing the relative drought resistance of species and varieties growing as whole plants rooted in soil. Lack of a suitable method of doing this has hindered an understanding of the response of species to drought and consequently the ability to plan action to ameliorate the effects of drought.

The Transpiration Ratio Study.—In this the changes in amount of water used per unit of dry matter fixed is to be used to assess differences between varieties of wheat and responses to changes in soil fertility, soil moisture content, and climate. One of the important results anticipated from this work is establishment of means of assessing the separate contributions to yield made by the inherent efficiency of the plant and phasic development in relation to climate conditions. This aspect of the work could provide a guide in selecting varieties for breeding, and a basis for understanding variations in field yields.

Soil Fertility

Agronomic Survey.—Four hundred and sixty-five wheat crops on 159 farms were sampled during the 1963-64 season. This operation was part of the Unit's long term effort to relate grain protein content to agronomic practice.

Grain protein contents ranged from 6.3 to 16.8 per cent, but mild seasonal conditions during ripening contributed to a generally low protein level. Wheat from clover land had an average grain protein content of 9.8 per cent in contrast to that from unimproved land which had an average grain protein content or 8.6 per cent.

Length of clover leys and amount of superphosphate applied over the ley period have again been shown to influence grain protein content appreciably. It was not possible, however, to relate grain protein content to intensity of cropping as in previous years. No explanation for this can be tendered.

Seasonal conditions within the survey area during 1963-64 were so favourable that only 1.3 per cent of the crops produced pinched grain (bushel weight less than 60 lb.). In almost every instance this small amount of pinching was associated with "take-all" incidence.

Nitrogen Studies.—Co-operative work with District agronoists at Cootamundra, Albury and Wagga Wagga suggested at nitrogen fertilizers are not likely to play an important le where soil nitrogen status is being maintained under wide tations associated with clover ley husbandry. By applying 0 lb. of nitrogen (urea) as a split dressing at sowing and wering, significant increases in grain yield were obtained only two of 11 sites. This follows an experience in 1962-63 ien the significant yield increase was obtained at only one e in a total of 21.

In a trial at the Institute the use of heavy rates of nitrogen rtilizer on a fertile soil severely reduced grain yield, from .2 bushels per acre without fertilizer, to 39.5, 36.0 and .0 bushels per acre with applications of 2.1, 4.2 and 6.3 t. of sulphate of ammonia per acre respectively. The lditional nitrogen reduced ear number (although initial tiller imber was increased), grains per ear and weight per grain.

Leaching of Mineral Nitrogen.—Leaching of mineral nitron and applied fertilizer nitrogen was studied during the 62-63 seasons. Evidence indicated that soil leaching on a d brown earth was likely to occur in the autumn-winter riod following the seasonal break, because the low evapoanspiration during this period allowed the soil to remain oist between heavy rains. During the spring months a gher evapotranspiration kept the soil relatively dry. This, gether with less frequent heavy rains, prevented leaching en under bare fallow conditions. Leaching of mineral trogen even during the autumn-winter period did not extend eyond the main root zone of the wheat crop. As a result, itrogen accumulated during the fallow period and was reined in the soil for use by the crop.

On naturally high-fertility soils, nitrogen fertilizer applied s sulphate of ammonia was slow to mineralise under averge seasonal conditions. With high rates of application, resiual ammonia-nitrogen was still present in the soil 12 months ter.

Fallowing.—With rising levels of soil fertility during the ast 10 years the number of crops sown on short fallow has icreased in the district. The influence of length of fallow n the release, storage and profile distribution of soil mineral itrogen, weed control, water storage and subsequent wheat ields is being studied. Associated is an enquiry into the pplicability of chemical fallowing in the wheat belt.

Phosphorus Studies.—Wheat Industry Funds have been iade available for an examination of the effectiveness of a oil Testing Advisory Service for wheat growers in southern lew South Wales. In the first instance a Pilot Scheme for hosphate requirements is being undertaken and the proramme is likely to extend over the three year period 964-66.

Soils from selected paddocks in the district are sampled rior to sowing and a variety of analytical methods is then mployed to evaluate and relate these tests with grain yield rom plots receiving five levels of phosphate—0, 50, 100, 200 nd 400 lb. superphosphate per acre. Superimposed on these lots are treatments with two levels of nitrogen—0 and 40 b. N per acre.

Other basic studies on phosphate requirements aim at a learer understanding of phosphate fixation and the residual alues from past dressings. It has been found that for an cid red soil and a neutral grey soil the major portion of the hosphorus added to the soil occurs as aluminium phoshate. This fraction is responsible for the supply of phoshorus to the crop.

Over a long period there is a transfer of phosphate from he aluminium to the iron formed. Iron phosphate is much ess soluble than aluminium phosphate and present indicaions are that it can make little or no contribution to the upply of phosphorus to the crop. Implications of this to gricultural practice are being investigated.

A field experiment with wheat using five rates of superhosphate—0, 90, 270, 810 and 2430 lb. per acre, showed hat the dry matter production of the crop at ear emergence vas greatly influenced by the amount of superphosphate pplied. Grain yields at harvest were not affected so greatly. oss of potential yield in the plants receiving the higher rates of application appeared to be mainly due to the death of illers during the latter stages.

The various treatments also influenced the proportions of he plant parts: the percentage of stem was increased and the ercentage of ears and grain were reduced at the higher rates. The proportion of the total phosphorus which accumulated in he ears was also reduced.

This differential uptake of fertilizer in the various portions of the plant will have a marked effect on the residual value at the higher rates of application.

DIVISION OF MARKETING AND AGRICULTURAL ECONOMICS

State Marketing Bureau

MARKETING BOARDS

Functioning Boards.—The Egg. Rice, Navy Bean, Wine Grapes and Lemon Marketing Boards constituted under the Marketing of Primary Products Act, 1927-56, continued to function.

Amendments to Regulations.—Various Regulations under the provisions of the Marketing of Primary Products Act, 1927-56, were amended. Boundaries prescribed for Electoral Districts in relation to the Rice Marketing Board were amended. Regulations in respect of sustenance allowances payable to members of the respective boards were amended to provide for an increased scale. The definition of an egg producer was amended by increasing from 150 to 500 the number of hens prescribed. A set of regulations for the functioning of the Lemon Marketing Board was prepared.

Polls and Elections.—A poll was taken under the provisions of the Dried Fruits Act, 1939-57, for the triennial election of members of the New South Wales Dried Fruits Board. In addition a poll was taken for the election of councillors to the Potato Growers' Association of N.S.W.

MARKETING REPORTS AND RELATED SERVICES

As required under the provisions of the Marketing of Primary Products Act, 1927-56, the Division continued to collect and disseminate detailed information from the operations of the various wholesale markets.

Marketing officers prepared reports on supplies, quality, prices and price movements at the City Municipal Markets (fruit, vegetables, poultry, fish and cut flowers), Homebush (cattle, sheep and pigs), Alexandria, Perry's Park and Sussex Street (grain, forage and hard vegetables).

Daily Service for Press and Radio.—Information collated was broadcast daily by the Australian Broadcasting Commission, including regional relays and interstate hookups. Some commercial radio stations also utilized parts of the marketing information. The daily press, periodicals, Federal and State Government Departments and instrumentalities, producer organisations, etc., are furnished with detailed marketing information per medium of the Daily Wholesale Price Quotations.

Retail Price Collection Work.—This was continued and the coverage of commodities and localities was increased. The retail price collection service covers fruit, vegetables, meat (beef, mutton, lamb and pork) and fish.

Weekly Marketing Notes.—The Division continued to prepare and widely circulate these detailed reports on the Homebush stock sales, sheep, cattle and pigs, and the prices and supplies of fruit, vegetables, cut flowers, forage, meat, fish, poultry, grain (local and overseas), miscellaneous farm produce and processed products. The Notes also cover cold storage statistics of butter, cheese and fruit.

Monthly, Price Trends.—The Weekly Marketing Notes, included at monthly intervals a series of averaged monthly prices for a comprehensive range of farm products, prepared from Divisional records.

Monthly Surveys.—These covered the collection of stock feed prices on a wholesale and retail basis, and wholesale prices of dressed poultry.

Inter- and Intra-State Supply Trends.—Records were maintained showing arrivals into Sydney by rail and sea of various primary products from interstate and intrastate sources.

General Information Service.—Numerous requests were received from State and Commonwealth Departments, from banks, and from private individuals in Australia and overseas, for information on prices and prospective markets for an extensive range of primary products.

Crop Reviews and Forecasts.—These services continued. Forecasts of production were prepared in respect of wheat, oats, citrus fruits and broom millet. The monthly publications, *New South Wales Pastoral Conditions* and the *Report on Production Trends* were regularly produced.

Meteorological Services.—A Divisional officer continued as the Departmental representative in the State Climatological Committee and liaison officer with the Weather Bureau.

Comprehensive meteorological records and data maintained in the Division provided meteorological advice and data for the Department as a whole and the public, in relation to farm pursuits.

Economic Research

Expanded Programme

The Division's economic research programme was expanded following a continued improvement in the professional staff position. The main research projects completed or in progress at the end of the year were as follows.

Optimum Enterprise Combination for Farms on the North-western Slopes.—This work was completed. The results were published in the *Review of Marketing and Agricultural Economics.*

Comparisons between optimal programmes derived from the study and what was being practised on survey farms suggest that farmers in the area could earn much greater profits by moving from existing practices towards the optimal programmes. Optimal programmes involve a maximum cropping of wheat, subject to maintenance of soil fertility which involves introduction of a legume crop—in the north-west this implies lucerne.

Implementation of optimal programmes as disclosed by the study would greatly extend arable acreage, by conversion of some of the natural pastures. The greater carrying capacity of lucerne would permit a similar total of livestock to be carried.

Linear programming solutions are often open to the criticism that they lead to unnecessary diversification of enterprises, due partly to ignoring the benefits of specialisation and economies of scale. But the optimal programmes from this particular study are more simplified than most of those currently practised.

Though quite small changes in profits assumed for the livestock enterprises are likely to necessitate changes in the programmes, the programme changes would only involve minor adjustments to composition of the livestock activities, e.g., substitution of crossbred ewes for Merinos. The broad outlines of the programmes presented are likely to remain valid in face of fairly substantial changes in the enterprise profits assumed.

For most farmers the size of farm is fixed. Their only alternative is to vary the amount of labour and equipment employed. This study has suggested that minimum size of farm to justify employment of two men is about 1,000 acres; of two men and a second tractor about 1,100-1,200 acres; of a third man about 1,500-1,600 acres.

However, it is sometimes possible to vary farm size: by purchase of additional land, by selling superfluous land, or when farms are established on new land or a large property resumed for the purpose. In such case optimal combinations of land, labour and equipment are obtained on farm sizes of about 1,300 acres for one man, about 1,450 acres for two men and two tractors, and 2,000 acres for three men and two tractors.

There is a wide divergency between the optimal size and the median size of one-man farms and to a lesser extent between the optimal and median size of two-man farms.

In most cases little can be done about existing farms but future closer settlement policy must place greater emphasis on the "optimum" rather than the "minimum" concept of farm size.

Economic Studies of the North Coast Dairy Industry.—The major project under this heading is a comprehensive study of the problems that north coast dairyfarmers face in adjusting to changing economic conditions and new technical developments. This project has reached an advanced stage and a report will be completed within the coming year. It includes an assessment of the role of alternative enterprise in lifting farm incomes in the north coast area. The assessment has already been valuable and used in a statement on the Economic Problems of North Coast Dairying.

Other subsidiary projects logically evolved from the main study are continuing. These include preparation of a report on share-farming problems in north coast dairying.

Economics of the "Feed Year" Concept.—This long term project was commenced in 1962 in co-operation with other Divisions of the Department. Good progress has been made. Two years of the three year development plan have been completed on each of the three farms. Production records on the farms show a substantial increase from development in the first year.

Full details of costs and pasture management problems are being recorded. Results will be subjected to detailed economic analysis.

A supplementary project is collection of production records from 30 farms in groups of 10, adjacent to each feed-year farm. These records are averaged and compared with past records to give a measure of the effect of seasonal conditions on the three project properties.

Field days conducted on each of the three farms have been well attended and have helped to familiarise district farmers with the progress.

Sprinkler Irrigation Economics on the Far North Coast.—The objectives of this project are detailed in last year's report. The case studies of the profitability of irrigation on selected dairy farms of the Richmond and Tweed River Valleys include a comparison of production levels achieved by irrigation and non-irrigated properties.

Some results on estimated production responses to soil moisture have been published in the *Review of Marketing and Agricultural Economics* (June, 1963) and some further results were presented at a Hydrology Symposium in Sydney, in a paper entitled "Towards a Production Function for Supplementary Irrigation on Far North Coast Dairy Farms".

The Water Conservation and Irrigation Commission has completed reports on the rate of water application and adequacy of design of the irrigation plants of the farms surveyed. This information is being incorporated in the now well advanced final analysis of the project.

Coleambally Irrigation Settlement Study.—Physical and financial records are being kept for twenty-four mixed farms and two horticultural properties. Records have been kept on eight of the mixed farms since early 1960, giving complete records for four financial years. Four have completed records for three years and the remaining twelve mixed farms for two years. The horticultural properties have only completed one year's records.

The project will provide data for a macro-economic study of the economics of the development of the irrigation area as a whole and a micro study of the economics of development of the individual farms with respect to: (*a*) capital accumulation, (*b*) cost of development, (*c*) rate of development in relation to initial capital resources, (*d*) range of incomes earned, (*e*) profitability of alternative farm enterprises, and (*f*) farm size.

The records in hand will shortly be analysed to examine objectives (*a*), (*b*), and (*c*) with a view to publication if the period of recording has so far provided any significant results.

This is essentially a long term project and all of its objectives cannot be accomplished until the properties are fully developed and have relatively stable production levels, particularly as regards objectives (*d*), (*e*) and (*f*).

Farm Management Study, Nowra District.—Progress of co-operating farms over the six-year period of study, 1958-59 to 1963-64, is to be analysed. Besides commenting on factors associated with financial success, observations will be made on (*a*) farmers' adjustments to chronic low-income situations, (*b*) trends in capitalization, capital-output ratios and capital-labour ratios, (*c*) sources of funds for new investment, and (*d*) trends in rates of return on investment.

Pattern of Industry Assistance to Rural Research.—This project, extended over two years, has been completed and will be published as "A Study of the Financing of Agricultural Research by Levies on Farm Produce". The author will first submit it as a thesis to the University of Sydney.

The report covers all aspects of the financing of research by levies. It includes the development of the statutory levy schemes, their organisation and allocation procedure, discussion of the significance of these schemes to agricultural research and to primary producers, and discussion of the criteria for allocation of farmers' and Government funds for agricultural research.

Appendices to the report show that almost £4,000,000 per annum is being made available through these schemes to finance agricultural research; an amount that is about 30 per cent of the estimated total expenditure on agricultural research in Australia.

Economics of Irrigated Cotton Production.—After this season's harvest the detailed records of ten crops grown in the South-western Region under irrigation will be available. Information from these records will provide a comprehensive report on the economics of cotton growing in the South-western Region of the State; including actual costs of production and returns for all crops so far grown, profitability, effects of the Commonwealth Government bounty, economies of scale, and problems in the introduction of cotton growing to farms in the Murrumbidgee and Coleambally Irrigation Areas.

There are thirty-eight potential cotton growers in the South-western Region this year. As many as possible will be requested to keep detailed records similar to last year's.

Subsequent extension of this study to include north-western cotton growers is intended.

Poultry Management Study.—This study in the Sydney area, referred to in last year's report, has been continued. A report of the individual results of six farms was published. For 1963-64, results will be available for eleven farms. The study will continue for a further twelve months.

The main purpose of the present study has been largely achieved. Therefore, consideration is being given to streamlining it and to expanding its size and scope so that economic organisation of the industry may be more thoroughly examined. Extension of scope may be possible by adapting the method of analysis to handling by the Public Service Board's Automatic Data Processing Division.

Pome Fruit Industry Study.—Field work for this study of the economics of production of pome fruits in the Batlow, Orange and Armidale areas has been completed. Of 136 growers interviewed, at least eighty were willing and able to provide financial information in a form that can be usefully used for financial analysis. However, only a few had reliable information for such basic physical details as level of production.

Most of the information from the questionnaires has been summarised and placed on punch cards. Analysis is proceeding. The results will be published during 1964-65.

Optimum Machinery Size.—Work continued on a project to collect figures and develop a model to provide a simple method for assessing the optimum machinery size on farms. The project has now been extended to include not only wheat harvesting machinery but hay balers and some similar machinery.

Economics of Serrated Tussock Control.—Based on results to date, two papers have been prepared.

The first, "Budgeting for Serrated Tussock Control and Principles for Development Budgets", was prepared mainly for use of extension officers of the Department. It dealt with principles of budgeting and discounting as used in long-term planning, with particular reference to serrated tussock control.

The second, "Economic Aspects of Serrated Tussock Control", was presented as a paper at the 1964 A.N.Z.A.A.S. Congress in Canberra. This paper dealt with economic considerations of control under six different sets of conditions. It showed under what conditions control measures were likely to be most profitable and where likely to be less profitable.

Farming Establishment Problems.—Completion of this project has been delayed by the absence, for most of the year, of the research worker concerned. He is on study leave in the United States of America. A report is likely to be available in the coming year.

Fertilizer Usage Economics.—The experiment referred to in last year's report is continuing. It is a whole-farm study of the economics of using nitrogenous fertilizers on pasture and fodder crops. The aim is to eliminate the need to purchase concentrate feedstuffs, by providing quality pasture and fodder crops all year round. This is a three-year project and some time must lapse before final results may be reported.

Barley Production and Marketing in New South Wales.—The study aims to delineate the major New South Wales barley producing areas, to ascertain the requirements of and the relative roles played by grain merchants, malsters, breweries, stock feed manufacturers and others in the utilization of this cereal, and to examine the possibilities for future expansion of the industry in New South Wales.

Time available for this project has been severely restricted by other commitments but it has progressed. Reasonably accurate data on the quantity of barley moving from southern New South Wales into Victoria and its subsequent disposal are possible. The latter details are essential to the study but earlier seemed impossible to obtain.

Bibliography of Agricultural Economics.—Compilation of *An Australasian Bibliography of Agricultural Economics*, 1788-1960 (in association with Dr. J. L. Dillon, University of Adelaide) has been completed. Typing of the manuscript will be finalised by September, 1964. Cost of publishing this work is very heavy. It is anticipated that sufficient subsidy will be forthcoming to ensure publication in 1964.

Honey Production and Marketing in New South Wales.—The second part of a detailed study of the honey industry in New South Wales, the investigation of beekeeping costs and returns on a management analysis basis, has been commenced. More than sixty beekeepers have been visited. Some field work remains. Analysis of returns is to commence shortly.

Concurrent with the study of costs and returns, attention has been given to some aspects of honey marketing. Recent trends in Australian honey consumption have been examined and a paper reporting the findings is to be published in a forthcoming issue of the *Australian Beekeeper*.

Farm Management Reconnaissance Studies.—Two area studies have been undertaken to provide basic information and some input-output data for use in farm management extension work. These studies have been called "Reconnaissance Studies" because they do not comprise full-scale survey but detailed case study of several properties selected to represent the spectrum of farms in a particular area.

The first of these studies was in the Illabo-Eurongilly area, in conjunction with members of the Faculty of Agricultural Economics, University of New England. The second was in the Tumbarumba-Rosewood area. Departmental field officers have been in all phases of each study.

Information provided by these studies may prove usable for detailed planning, perhaps using linear programming. Thus, these projects are potentially an important step in development of Farm Management Advisory Services.

Linear Programming Study.—Preliminary work is being done for a linear programming study of the organisation of a Hunter Valley dairy farm. Depending on results of this experimental study, it may be possible to extend the use of such studies as a practical tool in advisory services.

Hawkesbury Area Vegetable Industry.—On requests from the Vegetable Growers' Association of N.S.W. for a study of the economic organisation of vegetable producers in the Hawkesbury River area, an Economics Research Officer has visited the district for detailed discussions with industry representatives. The feasibility of a useful study of this area is being considered, but some months will elapse before the precise nature of it can be decided. One major problem is the absence of any reliable statistics for the vegetable industry.

Nature and Organisation of the Beef Industry.—Following the appointment of an Economics Research Officer to the position financed by the Australian Cattle and Beef Research Committee, a study of the nature and organisation of the beef industry has been commenced. Preliminary work on an economic survey of beef cattle producers in N.S.W. indicates that such broad survey would have relatively little value. It has been decided to suspend this survey, to concentrate on work of more direct value to the industry.

A thorough investigation of all aspects of demand for beef on the Sydney market is now proposed. This study will aim to determine whether a formal grading system should on economic grounds be adopted for beef. If the answer is affirmative an attempt will be made to determine where the grade boundaries should lie, on the basis of economic criteria. This latter part of the work would be undertaken in co-operation with technical meat specialists.

Following these studies, other beef marketing and cattle selling problems will be investigated.

Large Area Farms in the M.I.A.—Last year, preliminary work on a study of the relative profitability of spring versus autumn lambing under irrigation was reported. This is now being expanded to a complete study of large area irrigation farms in the M.I.A.; the previously mentioned work will form part of the more comprehensive project.

The aim is to arrive at optimum programmes for these farms, under various assumptions about product prices, resource supplies and input/output coefficients. Linear programming and variations such as variable price mapping will be used. A random sample of stratified farms will be surveyed initially, for basic data. Farmers will be invited to keep certain records for a period, where appropriate records are not readily available.

Other Projects.—Several minor projects were completed this year.

Among these was a study of the economics of a cattle feed lot in the south-west. It showed the fattening process quite profitable when actual costs of producing the haylage feed were used in the calculation. However, when a realistic market value was placed on the haylage, and this is the correct criterion in an economic evaluation of the enterprise, there was substantial loss. The conclusion was that it would be unwise to enter the feed lot business without an assured cattle market to buy and sell on, and until feed prices fall to levels making it uneconomic to produce feed for sale.

Advisory, Educational and Extension Activities

Farm Management Extension Services.—Little advance was made in further development of the farm management advisory service, due to continued difficulty in recruiting suitable, experienced staff. No further regional appointments were possible in these circumstances.

However, a number of schools and short courses in farm management and associated subjects were held for the farming community, and the series of in-service schools in farm management designed to advance all extension staff of the Department in their knowledge of the basic elements of farm management continued.

Policy Advice.—The Division continued to provide advice on economic policy affecting agriculture. It also continued to examine and advise on the position concerning imports and exports of coarse grains, protein concentrates and other farm requisites.

Quarterly Journal.—The Divisions' journal, *Review of Marketing and Agricultural Economics,* continued. A high standard has been maintained. Papers from agricultural economists employed in other organisations are accepted for publication in this journal. The Faculty of Agricultural Economics, University of New England, has submitted numerous papers.

Lectures at Extension Schools.—In addition to the organising of aforementioned farm management schools, officers of the Division addressed numerous schools organised by the Department, the Agricultural Bureau, universities and other organisations.

Officers also addressed various professional societies and other bodies on economic aspects of the rural industries.

Lecture Courses at Agricultural Colleges.—The Division continued to provide the lecturer in farm management at Wagga Agricultural College and also provided the lecturer in farm management for the newly established Farm Certificate Course conducted at Yanco Agricultural Research Station. The Division also continued to assist the lecturer in agricultural economics, Hawkesbury Agricultural College.

Lectures at the University of New South Wales.—Two officers of the Division have given short, part-time courses in aspects of farm economics to students in the School of Wool Technology at the University of New South Wales.

Representation on Committees

Officers of the Division of Marketing and Agricultural Economics continued as Departmental representatives in the State Nutrition Committee, the Markets Advisory Committee, and the Economics and Land Use Committee of the Hunter Valley Research Foundation. An officer also continued as one of the Ministerial nominees on the Rice Marketing Board. The Chief of the Division has been appointed a Departmental representative in the Gwydir Valley Investigational Committee. The Division has also provided the Chairman of the Yass Valley Project Technical Committee.

In the early part of the year the Principal Economics Research Officer occupied the position of President of the N.S.W. Branch of the Australian Agricultural Economics Society and was Vice-President of the Federal Body for the year. The Chief of the Division has occupied the position of President of the N.S.W. Branch since March, 1964.

DIVISION OF INFORMATION SERVICES

Scope

The Division engaged in the following work:—

- editing and production of publications;
- research liaison relative to science publications;
- information services and distribution of publications in response to 'phoned, postal and in-person requests by the public; and publications' bulk distribution to country offices;
- library services, in research-extension liaison;
- film library service;
- provision of audio and visual education aids and equipment for extension workers, and promotion of extension workers' skills in their use;
- cine film production, for television usage;
- promotion of extension group activities through the Agricultural Bureau of N.S.W. and kindred rural organisations;
- extension services for rural women and farm homes;
- organisation and in some cases tutorial staffing of short-term schools/courses for rural people and Departmental officers; and aid to other parts of the Department in staging similar schools/courses;
- training in extension service/extension methods, for officers of all Divisions and the Agricultural Colleges;
- extension service/extension methods courses, by invitation, for University of Sydney and University of New England 2nd Year students;
- Higher Grades (P.S.B. Reg. 124) examination of diplomate field officers, in extension service methods;
- representation of the Department and/or the Agricultural Bureau of N.S.W. in various councils, committees or boards.

Staff Numbers

There were 52 positions at 30th June, 1964; one more than at 30th June, 1963. The added position was that of a library assistant.

The total of 52 includes 10 librarian positions and the occupants of these 10 positions are Department of Education officers seconded by the Public Library of N.S.W. to the Department of Agriculture library services.

Also in the total is the Home Gardens Enquiry Officer whose salary is budgeted through Division of Plant Industry.

Three officers' positions arise from Commonwealth Grants, compared to four such positions at 30th June, 1963. The three positions are those of extension officer (display artist/designer), office assistant for library photocopying and cine film library, and a technical assistant in photographic and radio work whose salary is derived 50 per cent from Commonwealth funds and 50 per cent from C.R. funds.

An editorial assistant position with salary from Commonwealth funds ceased to exist as from October, 1963, when the occupant (Mr. J. D. Hatch) resigned. Earlier the N.S.W. Public Service Board had ruled as a result of an O & M survey that this editorial assistant position, created for special attention to Plant Industry Division's literature, should cease to exist—in exchange for a new research liaison officer position (C.R. funds). The latter position was filled as from 1st July, 1963 (Mr. J. N. Potter). Towards the close of the 1963-64 financial year the Public Service Board approved, subject to funds, creation of a new editorial assistant position (C.R. funds) for specialised attention to Plant Industry Division's literature.

New Undertakings

Reading-skills Training.—The Division has acquired some £400 worth of equipment and film to permit inclusion of reading-improvement training for officers attending the in-service Extension Service/Methods schools. This will help to reduce the problems innate to research-extension liaison. When the Division has become sufficiently experienced in this new teaching responsibility the reading-improvement training may be extended to Departmental officers in general.

Closed Circuit TV Camera and Monitors for Television-training of Extension Officers.—To enhance the television-training facilities at in-service Extension Methods Schools the Division has acquired about £800 worth of equipment including a Closed Circuit Television Camera, a 6 in. camera monitor/receiver, and 3 x 23 in. audience monitors/receivers. Similar equipment loaned by A.W.A. was worked at the Division's 1964 Extension Methods School and was a major factor in the television-training sessions.

The closed circuit TV camera and monitors are to be used also as direct extension aids at demonstrations where the monitors/receivers will help viewers to see the demonstrations more effectively. The first occasions will be livestock sessions at the Agricultural Bureau State Congress, Hawkesbury Agricultural College, in August, 1964.

Overhead Projectors, and Transparency-making Machines for Regions.—Ten overhead projectors and ten transparency-making machines have been acquired as additional extension aids equipment, one set for each of the nine Agricultural Regions and one set for Division of Information Services. Materials for use with this equipment have been acquired and arious aids to demonstrate the extension potential of the quipment have been prepared. A delivery and training inerary has been planned for July, 1964, involving the Extenon Officer (Photographic & Allied Aids) in a tutorial session ith field officers gathered at each of the nine Agricultural egion headquarters.

Transistorised, Miniature Tape Recorders for Regions.—Ten ransistorised, battery-operated tape recorders have been cquired, one for each Region and one for Division of Inforation Services. These are to facilitate and increase the cquisition of recorded field-interviews for use in farm radio essions. Field recordings, particularly farmer interviews, ave been hampered by the weight of and risk of damage o the high, broadcast quality recorders on issue to each ountry office associated with farm radio.

Research Liaison Service (Scientific Publications).—A new osition, "Research Liaison Officer (Scientific Publications)", ecame effective on 1st July, 1963. Duties of the officer equire him "to pursue reader research into science writings, ublications, reports; to be familiar with Departmental reearch workers' projects; and to re-write, write-up, or assist he writing of matter in a form suited to particular journals or other publications".

Experience during 1963-64 has already shown that one officer cannot hope to achieve and maintain within all areas of Departmental research sufficient familiarity to ensure ready publication of all that might be published.

Agricultural Gazette Mailing List Revision.—By including in the September to December, 1963, Gazettes an addressee revision coupon for completion by recipients the Division has received 9,830 return coupons from the approximate 36,790 addressees in the current mailing list. The other 26,000 addresses are being checked, e.g. for libraries, institutions, officers, etc., where non-return of the coupon may be explained by recipient assumption that only primary producers were required to observe the coupon system.

When the project is complete the mailing list is likely to be less than 15,000; as against 36,790 in the 1962-63 list. Meantime, during the year 1,520 new addresses have been added.

Numbering Departmental Publications.—Certain series of publications, e.g. *Insect Pests, Plant Diseases, Livestock Diseases* have long had a numbering system. These comprise a minority in the 900 total of miscellaneous titles. This year numbering systems for most of the Department's publications, within related series, have been commenced. This will facilitate libraries' access to the publications and help the citing of Department of Agriculture literature in journal articles.

Discontinued Functions

Advertisement Space in Departmental Publications.—Further to a policy decision, since 1st July, 1962 no contract has been written for sale of space in Gazette issues later than that of December, 1962. Paid-for advertisements appeared in some Gazette issues up to August, 1963, in fulfilment of earlier contracts. There have been none since then.

Cessation of Weekly Broadsheet Press Copy.—The weekly periodical *Press Copy* ceased to appear after the issue dated 27th March, 1964. It had been a Departmental medium for 40 or more years, channelling news matter to some 400 newspapers and radio stations as well as field officers and institutions in many areas of Australia. Production of it has been suspended, subject to review of the decision early in 1965. Shortage of staff in the editing section, to pursue copy, was the reason for suspension.

Editing Services

Press Copy.—Thirty-nine issues of the weekly *Press Copy* (circn. 1,170) were produced, and carried 364 articles and 21 blocks. Publication was suspended as from the issue dated 27th March, 1963, through lack of staff. The decision will be reviewed early in 1965 in light of staff developments.

Stereo loans to newspapers totalled 57, from blocks in the 39 issues, as against 75 loans from blocks in the previous year's 52 issues.

Roneoed Press Releases.—These totalled 50, compared to 27 in 1962-63 and 42 in 1961-62. Ten of the 50 releases were made in the final quarter of 1963-64, after suspension of the weekly *Press Copy* broadsheet. This suspension had little bearing on number of roneoed releases.

Agricultural Gazette.—Fourteen issues of the monthly *Agricultural Gazette of N.S.W.* were delivered in the 12 months under report, including issues for the final two months of the preceding fiscal year. Gazette circulation increased from 36,790 in 1962-63 to 37,858, but mailing list revision actions in hand and shortly to take effect will reduce the list to less than 15,000.

The Research Section introduced in the Gazette as from December, 1963, further to the appointment of a Research Liaison Officer, has been favourably received. Items from the section, including research pars, have been listed in the Australian Science Index.

Poor quality reproduction of illustrations in the *Gazette* since November, 1963, issue have been subject of strong protest by the Department.

Dairy Topics.—Of the scheduled six issues of this bi-monthly (circn. approx. 18,000) only two were delivered. A third is about to be delivered and material for a fourth is with the printer. One of the six issues for the year has been abandoned and the remaining one is increasingly behind schedule. Staff shortage has been a major factor.

Poultry Notes.—The scheduled four issues of this quarterly (circn. approx. 6,000) were produced.

Miscellaneous Publications.—Material for 287 jobs (excluding requisitions for stationery) went to the Printer, as against 169 in 1962-63. The 287 total included a greater than usual proportion of small jobs; for example, programmes or handbooks for coming events as extension conventions and short-term schools/courses for farmers and rural women. In any case the total of 287 was achieved only at such costs as only part production of the year's issues of the bi-monthly *Dairy Topics*, suspension of the weekly *Press Copy* after 39 of the scheduled 52 issues were produced, selection of material that needed least processing in the editing section before being sent to the Printer, foregoing many opportunities to improve publications prior to reprinting, and by work outside normal hours. The editing section was at less than half normal strength.

The Printer delivered 216 publications (excluding stationery) as against 213 in 1962-63. At 30th June, 1964, there were 124 jobs with the printer as against 90 a year earlier.

Jobs in the editing section at 30th June, 1964, receiving or awaiting attention totalled 178, as against 103 at 30th June, 1963, and 40 at 30th June, 1962. The total of 178 was additional to 63 in the hands of author Divisions for technical revision. The latter action would be inadvisable until there is a prospect of getting the revised matter to the printery within a reasonable time after such revision occurs.

"Research and the Farmer" Series.—Copy for No. 2 in this Regional series is under editing attention. Like No. 1 (published in March, 1963), No. 2 is from Southern Agricultural Region. The copy came to hand early in June, 1964.

"Weeds" Book 2nd Edition.—Stocks of the 1st edition (6,500 copies, 42s. per copy) are exhausted. The compiler (Mr. J. N. Whittet) is producing a 2nd edition by revision, on contract terms, and responsible to Division of Plant Industry.

"Pastures" Book 1st Edition.—First stock (7,000 copies, 42s. per copy) are expected to be delivered by the printery towards the end of July, 1964.

Research Liaison Section (Science Writings)

First Appointment.—As from 1st July, 1963, the initial establishment strength of one "Research Liaison Officer (Scientific Publications)" became effective when Mr. J. N. Potter—former Agricultural Bureau Assistant Organiser—took up his new appointment.

The Research Liaison Officer is required "to pursue reader research into science writings, publications, reports; to be familiar with Departmental research workers projects; and to re-write, write up or assist the writing up of matter in a form suited to particular journals or other publications affecting research and research extension liaison". Foundation work has been done in this 12 months by this first appointee.

Research Section of the Agricultural Gazette.—A regular monthly Research Section was commenced in the December, 1963, issue of the Agricultural Gazette. The Section comprises a number of research pars and not more than one research paper per issue. Twenty-nine research pars and five research papers appeared in the issues up to June, 1964. A greater total of research pars has been prepared and submitted for Gazette issues now at the printery. The number of pars per issue is expected to settle at near to ten.

Tutorial and Familiarization Work.—Twenty-four draft research papers have been subject of tutorial comment to authors. Eighteen familiarization visits have been made to research stations, laboratories, or district research offices, besides many visits to branches of the Science Services Division, Rydalmere. Increasingly, also, research officers are contacting the liaison officer for discussion and guidance.

Close contact has been maintained with the Editor of the *Australian Journal of Experimental Agricultural and Animal Husbandry*, Melbourne. This is a major outlet for papers by officers of the Department. The number of papers written by N.S.W. officers for this journal has substantially increased this year.

Enquiry Section

Excluding the Home Gardens Enquiry Officer's work (see later heading) the Enquiry Counter office-assistants handled 43,741 requests for service; a total roundly comparable with 45,552 handled in the previous year though 1,811 fewer. Each of those totals is barely half that of each of some recent years up to and including 1960-61. Thus the policy (see 1962-63 report) of steering rural enquirers towards the Department's Regional and District offices seems to be continuing to have a marked effect.

Of the 43,741 requests in 1963-64: 7,986 were telephoned, compared with 7,294 in 1962-63; 14,449 were postal, as against 17,116 in 1962-63 and 20,788 in 1961-62, *further illustrating the trend subject of comment in the preceding paragraph;* and 21,306 were in-person, compared with 21,142 in 1962-63.

Of the 14,449 postal enquiries in 1963-64: 10,482 were from rural and 3,967 from metropolitan addresses. This dissection is not available in respect of 1962-63 for comparison—but will be carried through into future years as an indication of trends.

Publications' Distribution

In response to the requests for service noted in the preceding paragraphs, the Enquiry Counter office-assistants distributed 591,139 items of literature—spread over some 900 titles. This was 252,651 items less than in 1962-63.

The total has been dissected into 441,423 despatched in bulk supplies responding to Regional and District offices' requests, and 149,716 items responding to in-person, postal and telephoned requests by rural and metropolitan public. In the preceding year 168,745 items were distributed to the public and 675,045 items were in bulk supplies to the Regional and District offices. Thus the trend commented upon in last year's report, whereby the greater distribution to clients is from country officers, appeared to have consolidated.

Reverting to discussion of the lower total of publications distribution this year, 252,651 less than in 1962-63, the explanation in part is that a lower total of extension publications was delivered by the printery in time to be effective before the close of the fiscal year. Deliveries from the printery late in June, 1964, were relatively heavy. Distribution in bulk supplies to country offices was 233,622 items less and to the public 19,029 items less than in the previous year. The heavy reduction in supplies to country offices was in part due to requested items being out or almost out of stock.

Sales

"Weeds" Book Sales.—From December, 1959, when the first edition became available for sale, to 30th June, 1963, the revenue from sales totalled £9,478. In the 12 months to 30th June, 1964, all remaining saleable copies of the 6,500 first edition were sold, and increased the total by £1,428 to £10,906. If a second edition (production by Division of Plant Industry is in hand) had been available there would have been many more sales in 1963-64.

Miscellaneous Sales Publications.—Revenue from sales other than *Weeds* books totalled £862, compared to £1,152 in 1962-63 and £982 in 1961-62. The reduced total for 1963-64 may be explained by *Bees and Honey, Trees of N.S.W.*, and *Dairy Farm Record Book* being out of print.

Advertisement Space Sales.—Revenue from this source was £623, including carry-over payments for space sold and used prior to 1963-64. Sale of space ceased during the preceding fiscal year and any advertisements carried in 1963-64 comprised fulfilment of contracts signed earlier.

Home Gardens Enquiry Officer

Individual Contacts.—Dealing with home garden and allied problems of types that the equiry counter office assistants could not service by resort to the literature range, the H.G.E.O. handled 6,352 enquiries, comparable with 6,544 in 1962-63, 6,455 in 1961-62 and 6,822 in 1960-61.

Of the 6,352, 1,964 were in-person enquiries, 1,048 were postal and 3,340 were by telephone. These proportions were similar to those of preceding years.

Mass Media.—The H.G.E.O. also produced the contents of roneoed extension statements on Cyclamen Culture, Gerbera Culture and Rose Propagation and assisted Division of Horticulture's production of a roneo on Cross Pollination of Fruit Trees. He also published articles in the weekly *Press Copy.*

Library Services

General.—The main library continued to be open to and well used by members of the public although literature may not be taken away by them on loan. Good relationships with other libraries were also sustained by generous inter-library loans. For the greatest part, however, the library work was concerned with intra-Departmental services to research and extension.

Branch Libraries.—Librarian assistance on a part-time basis continued for the branch libraries in the Divisions of Dairying, Horticulture, and Marketing and Agricultural Economics. Full-time service was given in the branch libraries at Hawkesbury Agricultural College, the National Herbarium—Royal Botanic Gardens, the Division of Science Services at Rydalmere, the Division of Animal Industry and Glenfield Veterinary Research Station on a joint basis, and the Wagga Agricultural College/Agricultural Research Institute, Wagga/Southern Agricultural Region Office, Wagga, on a joint basis.

In anticipation of transfer of the Divisions of Plant Industry and Horticulture to Rydalmere in 1965, increased library accommodation and furnishing needs there have been under consideration. Appropriate recommendations have been made.

The central librarian visited several of the decentralised institutions for library inspections and in situ discussions of possible developments.

Regional and District Reference Collections.—Of 604 books accessioned in the central library this year, 85 were purchased from Commonwealth Grant funds (Project 213) for location at country centres. There are now, from these funds, 2,048 books in reference collections at 78 country offices affecting extension.

Ordering and Accessions.—The central library placed on order 693 items using C.R. funds. The 693 included new periodical titles, covering actions for books received "on approval" and retained, and reprints and/or photocopies of articles published in various journals by Departmental officers.

In addition, using sundry trust accounts, 22 books and two periodical titles were placed on order for the Agricultural Research Institute, Wagga, 177 items and 17 periodical titles were placed on order and/or received for Hawkesbury College, and 152 items and eight periodical titles for Wagga College.

The grand total of items placed on order was 1,071 for all locations, including 72 periodical titles.

Accessions totalled 16,778 items, as against 17,535 in 1962-63. The accessions comprised 604 books, 10,878 issues of periodicals, 4,702 pamphlets (4,218 in series, 2,103 catalogued and 274 distributed and/or arranged by subject), and 594 annuals (49 bound volumes and 545 unbound).

Central Library Loans.—Some 31,240 items were lent, compared with 28,659 in 1962-63 and 33,727 in 1961-62. Of the 31,240 items, 24,591 were periodicals circulated (an average of 465 per week in and out) and 6,649 were miscellaneous loans in response to requests (av. 127 per week). These figures do not include the considerable volume of lending service provided by the branch libraries.

Inter-library Loans.—Of the 6,649 items lent by the central library, 5,172 were to officers of the Department and 1,158 were to libraries of institutions other than Department of Agriculture. The other 319 items in the 6,649 total were items loaned by the central library to officers of the Department after having been borrowed, on the inter-library system, from other institutions. As in the past, much more (1,158 items) has been lent to other institutions than has been borrowed (319 items) from the latter by the Department. This reflects the greater volume and range in the Department's library holdings.

The central librarian continued as a member of the Inter-library Lending Committee of the Australian Advisory Council on Bibliographical Services. This committee completed in May, 1964, a report for presentation to the Standing Committee of A.A.C.O.B.S. in August, 1964. The report is likely to have far reaching effect on inter-library lending procedures throughout Australia.

Reference and Literature Search Services.—The library staff continued to encourage and undertake reference and search assignments from Departmental officers, and did similar work for external organisations and the public. Reading lists resulting from each search were carded for future reference, and were also presented in the widely circulated Library Information Bulletin. Fifty-four lists from literature searches were so recorded in the Bulletins.

Library Information Bulletins.—Twelve Bulletins were compiled and distributed. These totalled 262 pages and listed 2,703 classified items; as against 180 pages and 2,231 items in the previous year. The Bulletins are now multilithed, in quarto size, with a formal cover. Improved presentation has enhanced the status and usefulness of the compilations.

Periodicals' Binding.—Some 474 volumes of unbound periodicals were collated and tied preparatory to binding; a marked increase on the total of 189 volumes so prepared in 1962-63.

Photocopying Service.—This service handled 554 jobs involving 5,625 sheets; compared to 463 jobs and 3,903 sheets in 1962-63. Since November, 1963, the library needs have been met almost entirely by access to the Department of Education Xerox machine. Hence it has not been necessary to replace the now worn photocopying equipment used in the library for ten years past.

Audio and Visual Aids Section

PHOTOGRAPHIC AIDS SERVICES—CINE AND STILL

Tutorial Services.—The Extension Officer (Photographic and Allied Aids) visited all Agricultural Regions for instruction and advice to extension workers re use of cameras, camera results, and the application of television to extension service.

He addressed some of the Regional conferences of officers, regarding photography for television usage, and presented similar sessions at the in-service Extension Service/Methods training school, 1964. At the close of the fiscal year a series of aids was completed for an instructional tour of Regional offices in July, 1964, in connection with field officers' use of newly acquired overhead projectors and associated transparency-making machines.

Field Officers' 35 mm. Photography for Extension.—Field officers' photography yielded 23,152 exposures this year, near to a 50 per cent increase on the 1962-63 total of 16,000. The 23,152 included 13,032 black and white and 10,120 colour shots. Each cassette of film is received in the Photographic Aids Section en route to processors and passes through the Section again en route to the field officers. The returns are diapositives for projection, and are accompanied by photographic advice where appropriate.

The great increase in camera work by field officers this year is in part due to the cumulative impact of younger, newer officers in extension service—accepting visual aids work as normal; and in part due to field officers' preparation for their future segments of television programmes.

Film-making for Television.—Four short films were completed, and field filming was done for four more. The completed films have had good use as segments of rural television programmes.

Special Purpose Photography Work.—1,350 photographic tasks were done; including enlargement prints and enlargement transparencies for use in show displays, extra diapositives from field negatives, prints for publications' blocks, and slide or print series for television programmes. Eight special enlargements (4½ ft. x 3 ft.) on cotton industry matters were arranged for the Royal Easter Show and have since then been used at appropriate country shows.

CINE FILM LIBRARY

Acquisitions.—Five new titles were added, for in-service training purposes. Each is concerned with reading-skills improvement: *Word Recognition Skills, Vocabulary Skills, Effective Speeds, Defining the Good Reader,* and *Comprehensive Skills.*

New Catalogue.—The revised catalogue (60 pp.), to replace the 1957 edition and its supplements, came into service in August, 1963. Copies were sent to all field offices and to Agricultural Bureau branches.

Film Loans.—In the previous year's report remarkable declines in film loans and programme collation were noted: declines from 1,913 films loaned, collated in 884 programmes, in 1961-62, to 644 films loaned, collated in 269 programmes, in 1962-63. This year, 1963-64, the number of films loaned was 812, collated in 325 programmes.

These increases in 1963-64 by comparison with 1962-63, though still far less than the 1961-62 figures, may be partly an effect of the new catalogue. But in the main they are due to film borrowings either for rural television uses or for assessment by country officers and rural television authorities —for possible future television uses.

At this stage there is a strong indication that rural television viewing, since 1961-62, has notably depressed rural groups' preparedness to seek or attend screenings of 16-mm. cine films.

RADIO AND SOUND SECTION

Tutorial Services.—The Extension Officer (Radio) did itineraries amongst District officers in four Agricultural Regions in company with the respective Regional Publicity Officer. The itineraries provided for advice on tape recording equipment, radio speaking styles and interviewing, organisation of matter and scripting; also advice on public address systems, cine film projection, and scripting for television.

Similar tutorial sessions were provided by the Extension Officer (Radio) at the in-service training school on Extension Service/Methods.

Tape Recordings for Rural Radio Sessions.—Not less than 43 of the rural radio stations in New South Wales provided one or more regular weekly farm sessions wherein Department of Agriculture field officers and/or their material were featured. A total of near to 4,000 separate broadcasts per year is made by the Department's extension workers through these channels.

Consistent with a longstanding policy of "local material for local people, by local officers, using local radio stations" the Division of Information Services has minimised the flow of head office tape recordings to Regional offices for use in local radio sessions. In general, the subject matter and volume of this flow has reflected only the need to supply from head office certain specialist information not otherwise available for the rural sessions. For example, there are no Women's Extension Service officers at country centres; hence a major portion of the head office recordings total comprised women's interest and farm-home material.

Tape recordings circulated from head office to country offices for use in local radio sessions totalled 148, compared to 107 in the previous year. The 148 included 91 talks and interviews from the Women's Extension Service, compared with 85 in the previous year; and 25 talks by or interviews with specialist, head office personnel.

Also, whilst the Extension Officer (Radio) was on rural itineraries for tutorial purposes he made many of the recorded interviews for which opportunities occurred. For example, in Northern Region he made 21 of the 24 interviews recorded during his week there.

Tape Recording Service for Personnel Training.—As a service to Personnel Training, lectures by Departmental authorities to junior clerks studying for Reg. 119 examinations were tape recorded and replicated for forwarding to similar junior officers stationed at country centres.

Equipment Developments.—Requisitioning and overall supervision of matters concerned with all audio equipment, including cine film projectors, and also 35-mm. slide projectors, have expediently become responsibilities of the Extension Officer (Radio) in recent times.

There are now 45 high, broadcast quality tape recorders in country offices of the Department affecting farm radio sessions. As recently as 1958 there were only six, although there were also 24 lower quality tape recorders wherewith field officers had gained a great deal of their early practice and radio confidence. All of the low quality recorders have now been recalled and disposed of; together with associated inverters, some of the older 16-mm. cine film projectors and 35-mm. slide projectors, and ineffective daylight screens.

Portable transistorised tape recorders (Ficord) have now been acquired for each Regional office, a new District office, and head office. These produce broadcast-quality recordings and are calculated to increase the percentage of true *field* interviews in the farm radio sessions.

Acquisition of a Closed Circuit Television System (CCTV camera, camera monitor, and three general monitors) as a teaching aid has been mentioned earlier in this report.

Display/Designing Section

Show Exhibits.—Artwork, signs and tickets were done to assist country officers' contributions to local Agricultural Shows in South Western, Mid Western, Western, Mid Coast and Hunter, Northern, North Western and North Coast Regions.

The Serrated Tussock Exhibit from the 1963 R.A.S. Royal Easter Show was adapted for and installed at the New England Centenary Show, Armidale, in February, 1964, at the request of the New England Noxious Weeds County Council.

The Cotton Industry Exhibit from the 1964 R.A.S. Royal Easter Show, subject of many congratulatory comments, was subsequently adapted for and installed at three sites in the north-western cotton growing areas; viz., at Narrabri Show, Wee Waa Show, and Wee Waa C.W.A. Hall for Cotton Festival Week. This exhibit has also been planned into the Forbes Show, September, 1964, and the Griffith and Leeton Shows, October, 1964.

Magnet Boards Made.—Magnet boards, serving also as chalk boards, and with flannelgraph surface on the reverse side, were made for each District office in Mid Western Region at the request of the Regional Supervisor. This was an outcome of earlier distribution of one combination magnet/flannel/chalk board to each of the nine Regions.

Other Lecture Aids.—Lecture aids, mainly charts, graphs and ticket writing, have been made in normal volume for use at short-term schools and courses for farmers, for conventions, and for in-service training schools. A greater than normal volume of such work was done for the three Women's Extension Service officers.

Publications Work.—In assistance to the Editing Section, the display artist/designer fulfilled a normal volume of line-drawings, cover designs, layouts and photographic retouchings.

Ticket-writing Training for Extension Workers.—A session on the rudiments of ticket- and sign-writing was introduced in the in-service Extension Service/Methods School this year, with the Display Artist/Designer as tutor. A degree of competency in this area will increasingly help extension workers, particularly in view of the growing interest in magnet boards, flannelgraphs, and overhead projectors as aids. Writing equipment and stocks of card for ticket-writing have been supplied to each Region for two years past. Library funds have also been used to requisition for each Regional and District office a teaching manual on ticket-and sign-writing.

The Agricultural Bureau ("Extension Groups")

Branches.—Eight new branches formed and four branches disbanded; 145 branches were affiliated with the State Advisory Council at 30th May, 1964, a normal percentage.

Branches' activity programmes have been consistently good as judged from their monthly reports and the visits by organiser staff to a cross-section of the branches. There is an apparent decline in attendances, an outcome of the increasing rural opportunities for television viewing.

A number of branches conducted short-term schools or jointly conducted them through a district council. There is a heavy demand for this type of extension activity. It cannot be fully met with existing tutor resources.

Divisional/Regional Conventions.—Seven Conventions were held: Richmond-Tweed Division's Convention at Wollongbar Research Station drew an attendance of 200; Mid Coast and Hunter Region's Convention at Bandon Grove drew 150; Central Coast-Cumberland Region's at Yarramalong drew 120; South Coast and Monaro Division's at Dalgety drew 150; Mid Western Region's at Boorowa drew 200; North Western Region's Division I Convention at Moree drew 100; and Macquarie Division's at Manildra drew 120. All were successful functions and deserving of commendations to the host branches, the organising secretaries and the committees responsible for various local arrangements.

Regional Organisation Adjustments.—Organisational adjustments have been made in various Bureau Regions. Because of distances the Bureau units have decided to abandon their Regional Council structure in the North Coast, North Western, Western, and South Coast and Tablelands Agricultural Regions. In each of these Agricultural Regions except Western the Bureau will operate two Divisions, each with a Divisional Council; in Western Agricultural Region the Bureau will operate three Districts, each with a District Council.

State Advisory Council.—All Regions except South Western were represented this year in the State Advisory Council. Six of the 10 Regions had two Councillors and three Regions each had one Councillor. These 15 Councillors, with two Women Councillors and the General President and Past General President comprised a Council of nineteen. Four meetings were held and attendances averaged 78 per cent. of maximum.

Matters given considerable attention by the Council included the decline of branch attendances, the influence of television viewing, the need for branches to approach educational subject matter in greater "depth" than formerly—since "surface information" needs are now largely met through extension literature, newspapers, radio and television. The Council's advice had been observed by branches and is one reason for the increasing demand for schools or courses presenting "depth" knowledge.

Important industry matters submitted to the Advisory Council by branches were appropriately channelled by the Council to the N.S.W. Chamber of the National Farmers Union, with which the Agricultural Bureau is affiliated.

39th State Congress.—The Congress, three days of educational sessions, was held at Hawkesbury College in May, 1963. There was an attendance of 190 delegates and visitors. To test August as a month likely to encourage a greater enrolment the next Congress will be held in this month of 1964.

Short-term Schools and Courses.—The demand for schools (consecutive days, and in some cases residential) and courses (one night per week for five or six consecutive weeks) increased spectacularly. But resources, in terms of people to provide the subject matter, determined that only a low percentage of the demand could be met.

Under a later heading the details of schools and courses promoted through or by the Agricultural Bureau and those also of the Women's Extension Service have been collated.

Special Lecture Tour by Animal Geneticist.—Clarence Divisional Council organised a successful lecture tour by Dr. J. S. F. Barker, University of Sydney Lecturer in Animal Genetics. Five branches were visited. Attendances aggregated 170.

Women's Extension Service

This Section, with a staff of three extension officers for the State, performed mainly through mass and group media: use of newspapers, journals, radio, Agricultural Bureau Conventions and branch meetings, women's sessions at field days, and short-term schools/courses. Individual contacts were in the main through correspondence, and in-person consultations by women attending some of the group functions.

Schools and Courses.—Twenty-three were conducted, as against 10 in the previous year. Four were of three days and 19 of one day duration. Promotion of the one-day type of school has been streamlined by shaping seven types ("Personality with Poise", "Understanding Ourselves", "Short Cuts to Better Dressmaking", "Homemaking with Modern 'Servants' ", "Planned Work—More Leisure", "Planned Wardrobe" and "Home Furnishing and Decoration") and circulating the availability of these to women's groups within the Agricultural Bureau throughout the State. The range will be increased.

Sessions at Agricultural Bureau Conventions and Field Days.—Nineteen sessions specifically for women's interest were provided at these rural gatherings, as against 29 in the previous year. The lower total for 1963-64 arises from the promotion of a greater number of *general* sessions for interest of men *and* women.

Non-Bureau Field Days.—Women's Sessions were provided at two Regional Agricultural Machinery field days and one Experiment Farm field day. The machinery field days were each of two days duration and the women's sessions were repeated four times at each.

Educational Fashion Parades.—Twelve of these were staged at rural centres, organised and staffed by the Women's Extension Service, assisted on four of the 12 occasions by commercial institutions promoting clothing patterns.

Talks at Meetings.—Thirty-six lectures or talks were delivered, at meetings other than Conventions, Schools or Field Days; the same total as in 1962-63.

Press Articles.—Thirty-six of the 39 issues of *Press Copy* carried extension articles by the women's service, a comparable rate to that of 1962-63; and 32 publicity statements re forthcoming events were prepared for Regional publicity officers' use.

Agricultural Gazette Farm Home Section.—Seventeen articles or notes for the Gazette editor's use were written or organised by the Women's Service, including five articles drawn from external contributors. The volume was comparable with that of 1962-63. The Women's Service also edited three Gazette articles on food preservation provided by Division of Horticulture.

Radio and Television.—The attempted rate was 12 tape recordings for each of the nine Agricultural Regions (one tape per Region per month) for use in local radio sessions. Ninety-one tape recordings of talks or interviews were thus provided; compared to 81 in the previous year. Also, nine tape recordings were made whilst visiting headquarters of Regions; and 30 tape recorded statements to publicise coming events were sent to Regional publicity officers for news uses. One television interview was provided, in Western Region.

Mail Enquiries.—Approximately 150 postal requests for women's interest information were handled; additional to several times that volume of correspondence concerned with organisation of schools, courses, conferences, fashion parades, field days, and script loans from the play-readings library.

Associated Country Women of the World.—The A.C.W.W. Vice President for the South Pacific Area visited to see something of the Agricultural Bureau women's work in N.S.W. A 14-day itinerary was organised for her. It included 10 Bureau branch meetings and two one-day schools.

Developmental Liaison with School Medical Service.—Through liaison between the Women's Extension Service and the School Medical Service, to increase the effect of the latter in rural areas, the Director of School Medical Service has this year made 20 tape recordings on expressed needs of rural parents. As a result of the broadcasts the School Medical Service has had increased requests from rural families.

Short-term Schools and Courses

The position of Extension Officer (Short-term Schools/Courses Organiser), vacant since October 1962, was reoccupied by a new graduate officer as from February 1964. By close association with the Agricultural Bureau Organiser the new officer is acquiring the in-service experience to fit him in due course to assist all parts of the Department concerned with schools and courses as extension aids.

Schools and courses with which the Division of Information Services was concerned this year, through the Agricultural Bureau and/or the Women's Extension Service, were as follow:—

Farm Management Schools/Courses.—Three schools were held, viz. at Tamworth, Tilba and Cowra. Others were sought but tutorial staff could not meet the requests. Economics Research Officers also provided a course for farmers at Orangeville-Werombi, and modified versions for farmers in the Northern and Southern Regions.

Soils and Botany Courses.—Three courses were conducted, viz. at Leadville, Cootamundra and Coonabarabran.

Beef Cattle Schools.—Two were conducted, viz. at Forbes and Casino.

Fertilizer Schools.—The first of this type has occurred. It was at Muswellbrook, with 116 people attending. Two others were held, viz. at Woodstock and Arcadia.

Pasture Production and Management Schools.—Two were conducted, viz. at Mudgee and Cooma. Many Bureau centres are seeking this type of school for 1964-65.

Dairy Cattle Health Course.—A six lectures course was promoted at Dooralong; the second of this type promoted by Dooralong branch of the Agricultural Bureau.

Sheep Production School.—One was held, locally organised by Lake Cargelligo branch of the Bureau.

Tractor and Farm Machinery Maintenance Schools.—Two one-day schools were arranged, one by Bookham-Berrimangra and the other by Murrumbateman Agricultural Bureau branch.

Leadership Schools.—Five were provided; a three-days school respectively at Young, Blayney, and Wellington for the Agricultural Bureau branches, a similar one at Molong for the C.W.A., and a five-days school held at Hawkesbury Agricultural College.

In women's service the following additional schools:—

Dressmaking Schools.—Four three-days schools were conducted.

Homemaker Schools.—Nineteen one-day schools were conducted on selected topics, including arts, crafts, sociology, and follow-ups to earlier schools on dressmaking.

Extension Service/Methods Training, and Examination

The Division of Information Services organised and staffed three training schools on Extension Service/Methods: the two-weeks in-service school for 45 Departmental officers, in January, 1964, at Hawkesbury Agricultural College, and one-week schools respectively for second year University of Sydney Agricultural Science undergraduates and second year University of New England Rural Science and Agricultural Economics undergraduates.

The Division also provided the extension service training content of a one-week school for Plant Diseases Inspectors, organised by Division of Horticulture, held at Hawkesbury College in May, 1964.

The Regulation 124 Higher Salary Grades examination paper on Extension Service/Methods was set and marked by the Chief, Division of Information Services, for the April, 1964, examination of field officers. Another paper has been set for the August, 1964, examination.

Representation in Boards/Councils

The Chief of Division of Information Services continued to represent Agriculture in the New South Wales Advisory Board of Adult Education and the New South Wales Film Council. He this year also joined the Editorial Advisory Committee (Melbourne) of the Australian Journal of Experimental Agriculture and Animal Husbandry, and is Chairman of the intra-Departmental Publications Advisory Committee.

The Agricultural Bureau Organiser continued as a State Councillor of New South Wales Junior Farmer Clubs. The Agricultural Bureau State President (Mr. L. B. Geelan) represented the Bureau in the New South Wales Council of Co-operative Societies, and the Bureau was represented also in the New South Wales Chamber of the National Farmers Union.

The Senior Extension Officer (Women's Service) represented the Department in the sub-committee of the New South Wales Division of the National Safety Council of Australia.

REGIONAL EXTENSION SERVICES

Each year since the establishment of the first Region in 1953, with headquarters at Wagga, has been marked by important developments in decentralisation of extension service administration and by progress in extension methods.

This year there has been rapid development of the use of television by officers, so that this mass medium for spread of extension information has become already an important aid in those Regions where there are television stations.

This year also has been marked by the appointment, for the first time, of graded male clerks to two of the Regions, and provision for similar appointments to the other Regions as personnel become available.

Administration of the Commonwealth Extension Grants is an important function of the Chief of Regional Extension Services. The Grants, to be used for extension purposes only, are made direct to the New South Wales Department of Agriculture by the Commonwealth Department of Primary Industry. The total is £164,000 per annum, comprising £89,000 under the Dairy Industry Extension Grant and £75,000 under the Extension Services Grant. These grants, since the first was made in 1949, have totalled £1,958,151 for New South Wales. This financial assistance has been of considerable value to the developing agricultural advisory services of the Department.

Personnel in Regions

Numbers and Additions.—Of the 442 officers located in country districts for advisory and regulatory services to primary producers, 391 are under the Regional administration system.

Officers added to Regions this year included an agricultural machinery officer (Southern), an agricultural economist (Western), a beef cattle officer (South Coast and Tabelands), two fruit inspectors (Western and South Western), a research agronomist (South Coast and Tablelands), 12 dairy herd recorders, and two male clerks (Southern and North Coast).

Office Accommodation

Further considerable improvements occurred in office accommodation in Regions, and plans in hand show similar developments for the coming year.

Wagga.—The Government Offices at Wagga, housing officers of the Departments of Agriculture and Education, are in a comparatively new building but accommodation is overtaxed. The District Veterinary Officer and his staff have had to find temporary alternative office accommodation. Plans are in hand to add two more floors, making four in all, and a lift service, also to provide further offices on a small area adjacent to the present building.

Orange.—Regional headquarters are in the Ophir County Council building constructed only five years ago. Increase in Department of Agriculture staff has led to five more offices being secured in this building.

Tamworth.—For many years the Regional headquarters have been in the old Department of Lands building in Tamworth. Increase in staff has created accommodation difficulties. The Department has fortunately made arrangements with the Government Insurance Office, to occupy modern offices comprising the full first and second floors of a building expected to be completed by December, 1964.

Maitland.—The Department occupies the complete, former Shire Council building in East Maitland now owned by the Maitland City Council. Additional appointments of extension and regulatory officers have congested the accommodation. Maitland City Council will spend £8,000 to provide additional rooms, garages and other facilities. This work has commenced.

Cowra.—Two years ago funds were made available for construction of offices on Crown land there, to be used by Departments of Conservation and Agriculture. Construction commenced late in 1962 but ceased for twelve months when the contractor became bankrupt. A tender to complete the building has been accepted and work resumed.

Finley.—Headquarters of officers in the Urana, Jerilderie, Berrigan, and Coreen Shires, were transferred from Berrigan to Finley. Finley has advantages, especially from the viewpoint of contacts with farmers. What was previously Finley Hospital has been taken over by the Government and by remodelling in part now provides a suite accommodating five officers.

Cootamundra.—Construction of the new Government Offices is well advanced.

Batlow.—The Department has been able to transfer from a single room in the local Co-operative Society's offices to three rooms in another building, providing ample accommodation.

Barham.—Improvement is anticipated. A local resident is constructing four new sets of offices, and one has been offered to the Department of Agriculture. The Department is hopeful of entering by the end of 1964.

Kiama.—A lease has been entered into with the Municipality of Kiama for use of four rooms in the old Council Chambers as Department of Agriculture offices.

Muswellbrook.—Office accommodation has been increased from two rooms to five rooms. Staff increases made additional office space imperative.

Other Offices.—Plans are in hand to construct Government Offices at Albury, Inverell and Moree. Present and future needs of this Department at those places have been indicated to the responsible authorities. In the remaining country offices, not referred to in this report, the office accommodation is satisfactory to excellent. In most places only increases in staff will give rise to needs for additional or new office accommodation.

Training of Officers in Regions

A policy providing for training prospective extension officers in Regions commenced late in 1962, and in the last 12 months has come into full operation. Some appointments of District extension officers have now been made as a result of it.

Through resignations of extension officers to take positions outside the Department of Agriculture, difficulty has been experienced in filling District vacancies with mature officers experienced in extension. Some Districts have had to remain vacant for long periods, or alternatively the vacancies were filled by appointment of officers with minimum experience and extension knowledge.

To improve the situation a scheme was adopted for location of officers in one or more Regions for periods of six to twelve months, for extension training. Following a report by the Regional Supervisor, a decision is made as to whether the particular officer is considered capable of operating in a District on his own. Many of the young officers concerned have shown ability. Four of them were appointed to vacant Districts this year.

Co-operation with Other Departments and Authorities

Regional officers maintained contact with many Departments and Authorities, with mutual benefit.

Regular inspections and reports were made upon farming and livestock sections of institutions administered by the Departments of Health, Prisons, and the Aborigines Welfare Board. Investigations were made on behalf of other Departments upon request, arising from claims by landholders for property damage.

At the request of Shire Councils and County Councils, four Weeds Schools were held. These schools were attended by Local Government officers and by personnel from the Railways Department, Bush Fire Administration, etc.

Regional Supervisors and quite a number of senior officers continued as members of Regional Development Committees. One Regional Supervisor is Chairman and another is Secretary of the respective Regional Development Committee.

The Department of Agriculture in conjunction with the Department of Lands inspects and reports on properties for closer settlement. Very close co-operation has been maintained between Department of Agriculture officers at Griffith and Leeton and the N.S.W. Water Conservation and Irrigation Commission in establishment of farms in the Coleambally Irrigation Area. There are 195 new irrigation farms at Coleambally on an area of 130,000 acres. Many of the farmers are new to intensive irrigation farming. The District extension officers, and particularly the Griffith agronomist, have spent a great part of their time assisting Coleambally settlers.

It is a responsibility of the Department of Agriculture to inspect and report upon properties operated by tenant and share farmers affected by flood or bush fire damage, and requiring financial assistance. These services were made through the N.S.W. State Flood and Bush Fire Relief Committee. The Committee depended entirely on country extension officers of the Department for the inspections and reports on farmer claims.

Conference of Regional Supervisors

A four days Conference of Regional Supervisors was held at Head Office in March, 1964. Development of agricultural advisory services, and general administration of Regions were discussed. Various institutions of interest also were visited by the Supervisors.

Regional Advisory Committees

The Advisory Committee in each Agricultural Region comprises seven primary producers, with the Regional Supervisor as Chairman. Committee membership is by invitation of the Minister. The Committees advise the Minister on agriculture in the Regions, and recommend means of improving farming standards or increasing agricultural production.

Many recommendations were made by the various Committees this year. One by the Mid Western Agricultural Region Advisory Committee was that with cereal research being conducted in the south at the Wagga Agricultural Research Institute, and in the north at Tamworth Agricultural Research Station and Narrabri Wheat Research Foundation, something comparable should be done for the west. As a result, £30,000 has been allocated for cereal research in central western districts and research officer appointments have been made.

Conferences, Schools, Field Days and Conventions

Increased Schools and Courses.—Demand from the farming community for farmer schools continued to increase. Such schools may be one day only or extend over three or more days. In some instances the schooling comprises a course, a series of sessions, one night per week for five or six weeks. Similarly there has been a marked increase in the number of schools or courses conducted for country women; concerned with homecrafts, clothes designing and fashions, modern home facilities, and sociological/family psychology topics.

Regional Conferences of Extension Officers.—The general policy of Divisional Conferences of officers at two year intervals, mainly concerned with technical subject matters, has been maintained by subject matter Divisions of the Department. In addition the general policy of a three year conference of all District officers in a Region, to discuss Regional Extension and administration, has been maintained.

During the past year such Regional conferences were held at Maitland, Cowra, Wagga, Gunnedah and Lismore. Emphasis this year has been on improved extension methods and new, modern aids. Developments in agriculture in the Region have also been highlighted; and at each Conference there have been "open sessions" providing all officers with chances to raise any matter desired.

Crop, Pasture and Stock Field Days.—Field days on farm properties, with educational sessions on particular crops, pastures, stock, or farm improvements have remained most popular. During the past 12 months not less than 540 of this type of day have been held. Some have been deliberately small promotions, with only a few local persons present. In other cases there have been as many as 500 people present. The best types from the viewpoint of extension and personal, farmer contact have been the field days held on demonstration projects with only about 20 persons there.

Night Meetings Decline.—There has been a notable decline in demand for and attendances at night meetings of farmers in districts where television viewing is now practicable. The decline in some Regions has been sufficient to make field officers consider night meetings now rarely worthwhile.

Conferences with Bank Managers.—Conferences have been held at various centres with bank managers, to acquaint them with the developments in agricultural research and extension. This has been particularly so in the North Coast Region. Practically all bank managers, some accompanied by a senior officer, attended these conferences in North Coast Region. The bank managers assessed the conferences highly.

Co-ordinated Extension Services

When the N.S.W. Food Production Council was established in 1952 a Co-ordinated Extension Services Scheme was commenced. The scheme provided that valuers of the Rural Bank, field officers of the Soil Conservation Service and of the Milk Board should give agricultural advice to primary producers, based on Department of Agriculture recommendations. This was the initiation of common policy in agricultural extension, for officers of different government Departments or agencies in contact with primary producers.

The scheme is still operative, although it has not made any marked development in recent years. In general, personnel of the different organisations have co-operated to provide sessions at field days and at farmer schools and conventions.

Flood Assistance and Relief

The Chief of Regional Extension Services and the Accountant of the Department of Agriculture are members of the N.S.W. Flood and Bush Fire Relief Committees. This year 64 meetings were held as a result of floods in north western areas and along the Hunter and Hawkesbury Rivers. Funds disbursed to primary producers and householders in consequence aggregated over £100,000. More than 1,000 applications for assistance were received; about 500 from farmers.

All claims from share and tenant farmers, and these were the majority, were investigated by extension officers of the Department. The Chief of the Regional Extension Services was the agriculturally experienced member of the Committee, but he took opportunities to invite various extension officers, investigating flood relief claims, to attend meetings when claims were being considered.

Libraries at Extension Offices

Mainly by use of Commonwealth Grant funds, books have been purchased for reference literature collections at country offices where extension officers are stationed. Approximately £5,000 has been spent in the purchase of some 2,400 books in the decentralised reference collections. At each of the nine Regional headquarters there is a comprehensive library of such agricultural publications, readily available to any officer in the Region. In addition, each District office within the Region has a smaller collection, typically about 30 books, of special application to the type of agriculture in the District.

Extension Literature for Distribution

Establishment of large stocks of pamphlets at each Regional headquarters has been one of the steps in decentralisation. Any officer in the Region has merely to contact the Regional Supervisor to obtain copies of literature produced by the Department. Earlier the District offices carried large stocks or the officers wrote to Head Office to satisfy needs.

An advantage of the Regional stocks scheme is that instead of numerous small consignments from Head Office to the 46 offices in Regions, a lesser number of bulk quantities were consigned to the nine Regional headquarters. Requests by country people direct to Head Office have continued to decrease this year, as knowledge of the leaflets' availability at Regional offices has diffused.

Regional Publicity

Press.—Publicity statements issued from Regional headquarters offices this year totalled 1,456; a reduction on previous years. The reduction has been brought about by the increasing amount of time given to television in some Regions and by the increasing volume of direct issues to the press by some District offices within Regions. A good example of the latter is West Wyalong District office. An estimated total of the issues by all officers in all Regions is 2,500 statements.

Improvement in form occurred this year. The top sheet of every press release now carries a heading "REGIONAL NEWS RELEASE" in 5/8ths inch letters on a green background, and supplementary lines identify the statement as from the respective Region of the N.S.W. Department of Agriculture.

Radio.—Practically all rural radio stations use material supplied by the Regions. On 43 of the 48 rural stations the Department of Agriculture sessions are regular. About 4,500 separate broadcasts were made this year by officers or from material supplied by them, and these contributions occupied 650 hours on-air; an average of 73 hours radio time per Region. None of the radio time was bought by the Department.

Some of the rural radio stations have found favour with the farmer with a broadcast early each morning, typically at 7 a.m., using material largely supplied by an office of the Department of Agriculture.

Other regular sessions have taken the form of a titled programme, such as "Digest", "Agricultural News", "Question and Answer", etc. Most of these programmes have been of 10 to 15 minutes length; and comprised short topical statements by Department of Agriculture officers, brief excerpts from officers' crop and stock monthly reports, and comments of local agricultural interest. The Regions have used the regular broadcasts also to publicise field days, conventions, schools for farmers, and similar events.

Television.—Television has now assumed a prominent extension service role in Regions where there is a TV station or where viewing is possible because of a station in another Region. Regions providing regular Department of Agriculture television sessions are Western, Mid Western, North Coast, Southern, and Mid Coast & Hunter.

The first regular programme commenced in March, 1963, at Channel 8, Orange, and has continued fortnightly on Tuesdays at 8.30 p.m. This time-slot has been a peak view-period. Officers of the Western and Mid Western Regions have co-operated to provide it. Comments by primary producers and the general public have been complimentary. Surveys have confirmed that this is one of the best "live" sessions from the Orange station.

An interesting recent development was the request by the management of Channel 3 at Newcastle to the Mid Coast and Hunter Region to undertake a regular session. Now there are two programmes each week by officers of the Mid Coast and Hunter Region from the Newcastle station.

Other Regions with regular television commitments are the North Coast (Lismore) and Southern (Wagga). In these as in the other Regions the guiding force has been the Regional publicity officer. He has arranged the programmes with the respective station, collaborated with field officers in script preparation, coached the officer concerned in the telecast, organised "live" material and graphics, and directed the rehearsals and telecasts.

Select Notes on Specific Regions

Mid Coast and Hunter Region

Floods Relief Claims Work.—No other Region in recent years has suffered so much production loss and damage to farm lands as Mid Coast and Hunter. Recurring floods on the Hunter (Maitland), Manning (Taree), Hastings (Wauchope) and Macleay (Kempsey) have placed many dairy farmers in a serious financial position. The most recent floods occurred towards the end of the 1963-64 year. Investigations and reports by Regional extension officers, on flood relief claims submitted by share and tenant farmers have been a major and rather continuous additional duty for officers of the Mid Coast and Hunter Region.

Machinery Field Days.—In liaison with the Agricultural Society at Maitland and the Agricultural Bureau at Muswellbrook, regional officers organised two major and very successful machinery field days. The Maitland Field Day was widely considered most successful, and arrangements are in hand for another in the spring of 1964. A brochure, 120 pages, compiled by a special committee of which the Regional Supervisor was Chairman, carried many articles by regional officers.

Mid Western Region

Wheat Research Move.—The Regional Advisory Committee's efforts to secure a wheat research institution in the central west, following developments in the south at Wagga and in the north west at Tamworth and Narrabri, have met with a measure of success. The State Wheat Industry Research Committee has allocated initially £30,000 to enable expansion of wheat research in the central west. Two research officers have been located at Condobolin Agricultural Research Station and a range of research projects has commenced.

North Coast Region

Dairy Industry.—Excellent liaison has been developed between research and extension personnel to bring about a whole-farm, feed-year programme. Three dairy farms were selected for demonstration purposes. Modern practices were adopted by the co-operating farmers. Results have been outstanding. It is being shown by the farms that, provided a farmer is prepared to invest and adopt Department of Agriculture recommendations, production increases of up to 100 per cent are possible.

One of the big factors in the increased production has been the success of research in determining suitable sub-tropical legumes. Their seed production has been a problem, but this has now been undertaken commercially in the Murwillumbah district. Many demonstrations on farmers' properties, using Commonwealth Grant funds, are to be sown during the coming spring.

Irrigation Developments.—Supplementary irrigation has appreciably expanded in recent times in the North Coast Region. This is demonstrated by comparing 1951 with 1963 statistics. In 1951 there were 205 licences issued, for 1953 acres; by 1963 this had increased to 821 licences, for 8,963 acres.

North Western Region

Expansion of Cotton Growing.—During the past year 8,000 acres of cotton were sown in the lower Namoi River area, as against 58 acres five years ago. The Department of Agriculture staged a comprehensive cotton industry exhibit at the Sydney Royal Show in 1964, and subsequently adapted the major part of it at the Narrabri and Wee Waa Shows.

Retirement of Mr. J. A. O'Reilly, Regional Supervisor.—Mr. J. A. O'Reilly, an officer of the Department of Agriculture since 1921, retired on 29th May, 1964. Mr. O'Reilly, stationed at Gunnedah for 34 years, was a longstanding force in the development of north western agriculture. Mr. O'Reilly has been widely acknowledged for his key role in the striking advancements of wheat growing in the north west.

South Coast and Tablelands Region

Yass Valley Project.—This project, developed from a Research and Extension Study in the Yass district conducted by the N.S.W. Department of Agriculture and the C.S.I.R.O. in co-operation, aims to demonstrate on farms under the personal management of the owner the value of recommended farming practices. The base study was most comprehensive, over a six years period. Ten reports were issued by the study group. The recommendations in these reports are being put to practical test in the Yass Valley Project. Members of the project committee comprise farmers and graziers, businessmen, bankers, and officers of the Department of Agriculture and C.S.I.R.O. A series of mixed farming properties are being used in the project.

Educational Visit to New England.—Members of the Regional Advisory Committee decided on a visit to the Department's Shannon Vale Nutrition Station at Glen Innes to evaluate the pastures and sheep management research there in relation to southern tablelands conditions. Five members of the Advisory Committee accompanied by all extension officers in the South Coast and Tablelands Region visited Shannon Vale. This visit was considered invaluable. Moreover, the Advisory Committee members, mostly graziers, have continued in correspondence with northern tablelands graziers and one has already made a return visit to the north with fellow graziers.

Co-operation in Serrated Tussock Control.—Serrated tussock is particularly serious in this Region in the Anembo area. A number of infested properties placed on the market at comparatively low prices were taken up by people with capital, and confidence in recommended control measures.

Four properties totalling 7,000 acres, with 2,500 acres densely to moderately tussock-infested, were purchased by owners who agreed to work together to control the tussock. Meetings have been held, a firm agreement has been prepared and signed, known as the "Anembo Project"; the Shire Council and Commonwealth Development Bank are co-operating, and Department of Agriculture recommendations are being adopted.

Southern Region

Officers Visit to New Zealand.—Regional Supervisor Mr. R. C. Madsen accompanied by Economics Research Officer Mr. G. F. Donaldson visited New Zealand to study the extension services and in particular the farm management advisory service.

A combined report on the visit was prepared. Copies were forwarded to the Public Service Board and Department of Primary Industry. Funds for the visit were made available from the Commonwealth Extension Services Grant and Commonwealth Dairy Industry Extension Grant.

Record Subterranean Clover Seed Harvest.—There was a record production in the Region this year; 2,203 tons of subterranean clover seed, as against the previous record 1,850 tons. A feature was increased production of strains other than Mount Barker. The vacuum-type harvester has increased rapidly and is replacing the sheepskin roller.

Private Rural Advisory Services.—There are eight private rural advisory groups in the Southern Region; an increase by two this year. A trend worthy of note is that the advisers to three groups terminated their group employment status and have established themselves as consultants in private practice.

SOUTH WESTERN REGION

Expansion in Irrigation Development.—In the Coleambally Irrigation Area 51 more farms have been settled. It is anticipated that 195 farms, occupying 130,000 acres, will be settled by the end of 1964. Development of the Coleambally Irrigation Area has been remarkable. Although the settlement commenced only in late 1959 the area sown to crops and pastures at the end of June, 1963, was 17,000 acres. Production for the year ending 30th June, 1963, was valued at £616,000.

Private irrigation development from pumping along the Murrumbidgee, Murray and Lachlan rivers has taken on major importance in the Region. Latest available figures show that about 265,000 acres are now watered from licensed pumps.

Some of the privately developed schemes are of considerable magnitude. Moira Irrigation Scheme (south of Deniliquin) involves some 64 holdings, and the intention is ultimate irrigation development of 20,000 acres.

Cotton Area Increased.—Cotton acreage in the Region increased from 1,300 in 1962-63 to 2,000 acres in 1963-64. Good yields are being obtained. Of significance, a cotton gin has been constructed at Darlington Point. A survey has indicated that some 5,000 acres will be sown for 1964-65 season.

Italian Extension Liaison Officer.—Although more Italians are now learning the English language there is still need for the English-speaking Italian Liaison Officer to translate and convey agricultural advice to the Italian farmers. Persons of Italian origin comprise 98 per cent of the large vegetable growing industry in the Murrumbidgee Irrigation Area. Vegetables are grown on 8,090 acres there.

In addition to direct contact with individual Italian farmers, the liaison officer prepares material for the press and the *Farmer's Newsletter.* By these means the Department of Agriculture services have become favourably known to the 50 per cent of the local farming community with whom contact was previously very difficult.

WESTERN REGION

Fruit Storage and Handling Trends.—The Western Region's area under commercial orchards further increased, and now exceeds 12,000 acres. Spectacular developments have been in adoption of bulk handling and increased cool storage in the Orange district. Fifty growers, who between them harvest 400,000 bushels of apples and pears, have adopted bulk handling. They account for one-third of the pome fruit in the district. Meantime, fruit cool storage capacity at Orange increased this year by 100,000 bushels and now totals 1,146,000 bushels.

In-Service Schools.—An in-service Farm Management School for extension officers of the Region was held at Bathurst in October. A school was also held at Bathurst in February for newly appointed Departmental trainees, when the Regional Supervisor and other officers provided sessions on regional administration and extension.

Big Increase in Use of Superphosphate.—The area under improved pastures in the Western Region increased last year to 2,500,000 acres. A striking increase in superphosphate usage was associated. Whereas 87,000 tons was used in 1962 the quantity near doubled to 167,000 tons in 1963.

NORTHERN REGION

Property-Ownership Changes' Effect.—Throughout the year there has been a large turnover in property ownership—mostly on the tablelands although all districts have recorded sales. Early in the twelve months, reasonably developed properties were typical. Latterly the buying pressure has raised selling prices substantially and emphasis has changed to the "potential" rather than the actual development.

Extension officers at Tamworth, Armidale and Glen Innes, in particular, have received many enquiries from land seekers. The majority of seekers have come from southern New South Wales.

The situation will foster increased rate of development of the northern tablelands' potential, but the wave of enthusiasm has resulted also in sales of properties on the problem granite soils of the western fall of the tablelands—to purchasers who could soon regret their decision. In favourable conditions these areas look attractive and could be over-rated. At the current level of knowledge of those soils there is no answer to the problem of improved-pasture survival in dry times.

Commonwealth, Extension Services Grants

The Chief, Regional Extension Services is administrative officer within the Department of Agriculture for the Commonwealth Agricultural Extension Services Grant and Dairy Industry Extension Services Grant.

AGRICULTURAL EXTENSION SERVICES GRANT

Availability of funds amounting to £75,000 per annum from this Grant has *inter alia* enabled many extension demonstrations to be conducted on farmers' properties.

Demonstrations.—Since the Grant commenced in 1952 there have been 4,500 such demonstrations.

Many have been to demonstrate recommended pastures and pasture management techniques. Extension officers have conducted field days at the demonstrations and given to other farmers on-the-spot recommendations based on the plots.

Other demonstrations have been concerned with crops, fodder conservation, livestock and horticulture.

Outstanding demonstrations concerned with livestock have been those to show beef breeding stock improvement by herd selection, based on regular weighing of calves to assess their rate-of-gain characteristics. The first of these demonstrations was commenced at Bombala in 1955. This one has shown that by selection of sires and dams, based on rate of gain of weight by calves, it is possible over a period of three years to increase the weaning weight of calves by 15 lb. Today maiden heifers are weaning calves over 30 lb. heavier than maiden heifers did eight years ago. The cattle breeder concerned is in fact now pricing and selling his bulls on their weight-for-age and conformation grade rating. Buyers are aware of the value of these records and the majority of sales made are based on them.

Publicity Officer Positions.—In each of the nine Agricultural Regions there is a Publicity Officer to co-ordinate and otherwise improve releases by extension officers for use by press, radio and television. These officers are employed on Grant funds.

Extension Aids Equipment.—The extension officers statewide have access to a comprehensive range of equipment aids—film and slide projectors, overhead projectors, tape recorders, episcopes, public address systems, office-duplicating equipment, etc. Much of this equipment has been purchased with Grant funds.

Field Assistants Employed.—To assist extension officers in the conduct of demonstrations and to relieve them of some routine duties, 27 field assistants are employed on Grant funds, and each is provided with transport on Grant funds. Availability of these officers has enabled many more demonstrations to be conducted than would otherwise have been possible. They assist also in such ways as seed certification, organisation of field days, and equipment maintenance.

Fruit Packing Instructor Employed.—In addition to advising on fruit packing to individual orchardists this specialist this year conducted 27 fruit-packing and grading demonstrations or classes. He also developed a suitable pack for the new banana case, and has drawn up a chart of packs which the Banana Growers Federation has adopted.

Agricultural Machinery Officers in Regions.—In no other field during the last twelve months, as far as practical advice and extension to farmers are concerned, have appointments of extension officers proved more popular or successful. The three Agricultural Machinery Officers so far employed are in constant demand. Many compliments have been made by primary producers, on advice which has saved many pounds or enabled purchase of the most appropriate equipment.

Overseas Study Tours.—This year the Regional Supervisor, Southern Region, on Grant funds visited New Zealand for a month's study of agricultural extension organisation and services.

DAIRY INDUSTRY EXTENSION SERVICES GRANT

New South Wales receives an annual £89,000 from this Grant. It supplements the Department of Agriculture advisory services in dairying districts. In 1963-64 the Grant funds were expended under nine different projects.

Grade Herd Recording Scheme.—This is one of the most important projects. Dairy farmers may have milking cows productivity tested at regular intervals, to assist the breeding programme for herd improvement. Fund increase this year allowed a 15 per cent increase in the number of cows tested under the Scheme. Over 80,000 are now tested.

Bull-proving Scheme.—The Herd Recording Scheme has prompted the successful application of a highly important bull-proving scheme. Progeny performance of young bulls is "proved" quickly, determining their fitness or otherwise for use in the New South Wales Milk Board's artificial insemination programme.

Sire Survey.—This is another project important to artificial insemination. Under this scheme, bulls in registered studs are "proved" on the productivity of progeny. Data from this survey will facilitate stud breeders' planning of breeding programmes as well as provide information for artificial insemination purposes.

Punch Card Equipment.—Funds from the Grant have also been used to purchase costly punch card equipment, to facilitate processing of the data from herd recording.

Personnel Employed with Grant Funds.—These include field assistants and milking machines survey officers. The former carry out many routine duties, and consequently release extension officers' time for advisory activities.

Milking Machine Survey Work.—Hundreds of milking machines have been closely examined and tested by the milking machine survey officers. The data has resulted in many improvements and refinements in the efficiency of milking and removed numerous causes of adverse effects on cows. Better methods of cleaning machines and desired standardisation of equipment have also been valuable contributions from this project. Improvements in testing equipment contiue to be affected in a special laboratory at Hawkesbury Agricultural College.

Dairy Topics Journal.—Advisory service improvements have been made possible with Grant funds. Amongst these is the bi-monthly publication *Dairy Topics,* issued free to all dairy farmers, though only two issues appeared this year—because of journalist staff shortage.

Extension Aids Equipment.—The funds have also been used to supplement cost of producing films and slides for use by extension officers in lectures and television programmes, and to expand the film library used by farmer organisations and field officers.

Recent new items of extension aids equipment included overhead projectors, copying machines and portable transistorised tape recorders for each Agricultural Region.

The display artist/designer employed on Grant funds has continued to assist field officers in the preparation of lecture aids, graphics, and material for show exhibits.

Demonstrations.—Numerous field and equipment demonstrations have comprised another important aspect of expenditures from the Grant.

Agronomy demonstrations have shown the relative values of various new pasture and fodder crops as high quality protein-rich feed for dairy cows during critical months, and have especially demonstrated means of stabilising production on the north coast.

Demonstrations of new equipment for better dairy hygiene, and of water-cooling towers to improve cream quality, have helped the trend whereby increasing numbers of farmers are adopting modern methods.

"Solids-not-Fat" Project.—Valuable information from a project designed to seek data on solids-not-fat content in milk is being printed. Recording methods are being tested and information obtained to explain variations in the solids-not-fat content of milk.

University and College Traineeships.—The Grants continue to be used also to provide traineeships at the Universities and Agricultural Colleges, the trainees subsequently to join the staff of the Department.

Investigational Tour in New Zealand.—For a study of farm management advisory services in New Zealand, funds from the Grant enabled the Economics Research Officer, Southern Region, to visit New Zealand in November, 1963. The information he gained has been of special value to extension officers and rural group advisors.

HAWKESBURY AGRICULTURAL COLLEGE

The Diploma Courses

DIPLOMA IN AGRICULTURE

New Entrance Standards and Enrolment Procedure.—Following implementation of the Wyndham Report in Secondary Schools, changes in minimum entry standards for the College Diploma courses would be expected. The new minimum entry standards and altered procedure for enrolments, to operate in 1966 and thereafter, have been recorded earlier. (See p. 19.)

Current Developments in the Course.—Much attention has been given to ensuring that the College is more adequately fulfilling its prime, educational function. Pending introduction of the revised curriculum in 1966, improvements have been made in students' practical work, class-room accommodation, teaching-aid material, and guidance of students' curricular and extra-curricular activities.

A Supervisor of Practical Training was appointed in January, 1964. The field Work Roster is now much more flexible. Closer supervision of each student's practical training is being achieved. The roster is gradually being modified to give senior students opportunities to specialise in chosen fields, more particularly where a student knows what career he will follow. Efforts have been made to create teaching situations wherever possible.

A Tractor Operator Training Scheme was commenced; closely supervised training from early in 1st Year, in a graded set of skills culminating in the student being certified as a competent operator.

DIPLOMA IN DAIRY TECHNOLOGY

A preliminary survey of the needs of the dairying industry for categories of employment for Dairy Technology diplomates has revealed that the present average out-turn of fourteen per year is fairly close to the needs. The industry has expressed general satisfaction with diplomates, subject to two constructive criticisms.—

(1) The course should include increased emphasis on business training and personnel management;

(2) there is no urgency to lengthen the training period for all students but a selected few could be given the opportunity of a further year to treat some basic subjects at greater length and depth.

The College is attempting to keep up-to-date with increasing technological developments, and with new trade horizons in the near north—with inevitable changes in exportable dairy products components, e.g., recombining milk.

Increasing enquiries about Dairy Technology training are being received from Asian countries. During 1963 two Colombo Plan students from the Philippines were given three months special training in dairy factory engineering and a student from Pakistan received five months training in the manufacture of cheddar cheese.

DIPLOMA IN FOOD TECHNOLOGY

The considered optimum intake of fourteen students in first year was not realised in 1964, as only eleven of the forty applicants reached a desired minimum standard for entry. Attention is being given to more publicity for this Course, with emphasis on the need for higher minimum admission standards.

The outlets for employment in the food industry are so diversified and the pace of technological developments so rapid as to justify the goal of much higher calibre entry standards than at present.

Lengthening of the Course to three years would not be an unreasonable objective, in view of the needs and opportunities in the industry.

Training in the preparation of a wide variety of preserved foods continued. Over eighty different products were processed. An indication of volume of production is given by the figures for materials processed: 12 tons fruit, 17 tons vegetables, 5 tons tomatoes, 2,500 quick-frozen poultry.

The food industry continued to assist development of this Course by sponsorship of students, gifts, long-term loan of equipment, assistance with tours and special schools and in other ways.

GENERAL

In-service Training for Lecturers.—Twelve of the lecturing staff attended a school in "Rapid Reading, Comprehension and Study Methods", conducted by the Department of Education.

A number of modern teaching aids was demonstrated to staff. This enabled the lecturers to appreciate what was available and evaluate the potential for College use. Some tems have been obtained or are on order.

Student Tours and Visits.—Annual instructional tours and visits were conducted as usual. Attention is being given to widened scope and improved effectiveness of tours and short visits.

English Expression.—The remedial thirty-lecture course in English Expression, commenced in 1963, continued in first year curriculum in all diploma courses. As the course is essentially remedial, and because of some difficulty in obtaining the services of teachers, only seventy of the 107 first year students have been required to attend. Evidence of improvement in expression has shown in examination papers.

Counselling.—The system of having an officer as counsellor to a group of about twenty students was continued; and one officer kept students informed on career opportunities.

Student Extra-Curricular Activities.—The Students' Representative Council, the Sports Club, the Debating Society, the Camera Club, the Student Christian Movement and the College branch of the Agricultural Bureau continued to contribute to the welfare and social life of the College.

An officer has been appointed officer-in-charge of each extra-curricular activity. Students will continue to run their own affairs but the respective officer has this status, for guidance and liaison purposes.

The Australian Agricultural Colleges Intercollegiate Contests in Rifle Shooting and Tennis were held at this College in August, 1963.

Short Course Schools, and Conferences.—College facilities and, in some cases, staff were made available for the following short course schools, conferences and field days: School for Dairy Farmers, School for Food Factory Foremen, a Plant Industry Regional Conference, Biennial Conference of the Society of Dairy Technology, Tractor Maintenance School, Men's Leadership School, two Schools for Junior Farmers, Conversion Course for Cream Testers, Farm Managers Conference, Agricultural Engineering Society School on "Wool, Water and Wheat", Poultry Farmers' Field Day, Department of Child Welfare School, Summer School in Apiculture, Department of Agriculture Extension Methods School, Department of Technical Education School, Fruit Inspectors Extension Methods School, Poultry Farmers School, Dairy Factory Apprentices School, Refresher Course for Dairy Officers and Livestock Officers (Dairy Cattle), Herd Recorders School, and the Amateur Beekeepers Association Field Day.

The School for Pig Farmers was again cancelled due to the Swine Fever problem.

Public Relations.—The College continued to foster good relations with the local community. The swimming pool was made available to schools, during sports afternoons and to the local organisers of a learn-to-swim campaign.

During the June, 1964, flood disaster, staff, students and facilities were made available through the local Civil Defence Authority.

Arrival of visitors on the normal Visitor's Day, Thursday, is so regular that staff and students continue to be rostered for the occasion. By special arrangement on other days, including week-ends, visitor individuals and groups have been allowed. Most visitors have a real interest, either general or specific in the College activities. The visits are accepted as as informal, effective extension.

Agriculturists from other States and from overseas, including many from Asian countries, who are usually Colombo Plan Fellows, have visited. Mutual benefit has been derived from the contacts.

Student Enrolment Statistics.—At the commencement of 1964, there were 239 students; 192 are pursuing the Agriculture Course, twenty-five the Dairy Technology Course and twenty-two the Food Technology Course.

The trend continued for most students to enter the College Diploma Courses with a higher standard of education than the present minimum standard. The educational standard of entrants in 1964, compared with 1963, is as follows:—

Standard	Agriculture Per cent.		Dairy Technology Per cent.		Food Technology Per cent.	
	1963	1964	1963	1964	1963	1964
Leaving Certificate Pass	59	76	41	6	94	91
Leaving Certificate Failed ..	8	6	12	..	6	9
4th Year	16	13	18	..	nil	..
Intermediate Certificate	17	5	29	39	nil	..
	100	100	100	100	100	100

Diplomas and Passes Awarded.—The Diplomas and Passes awarded on the 1963 examinations comprised 53 Diplomas in Agriculture, 13 Diplomas in Dairy Technology, and 13 Diplomas in Food Technology (including one 1962 student permitted to attend the 1963 examination). One Class I and six Class II Honours were awarded in Agriculture, two in Dairy Technology and two in Food Technology.

Vocations of the Diplomates.—Of last year's 53 Agriculture diplomates, 21 are employed on farming and grazing properties; eight entered State Departments including two Departmental trainees at University, and five entered other governmental agencies; private firms accepted five as technical representatives and in other capacities; five entered companies associated with agricultural and pastoral industries; one accepted a miscellaneous employment, and the vocations of eight are unknown.

Thus, 34 Diplomates of the 1963 Agriculture class are either on the land or employed in governmental agencies. Most of those in the latter category, plus the 10 employed by private firms, are directly or indirectly applying their College training to the promotion of better agriculture.

Sources of Agriculture Enrollers.—Of 192 students currently enrolled in the Diploma in Agriculture course, 75 are the sons of farmers. Of the 83 students enrolled in the first year of the course, 29 are sons of farmers.

National Status of Technology Courses.—The national character of the training in the Dairy Technology and the Food Technology Courses has again been implied by the admissions from other states and also by the employment of many diplomates in other parts of the Commonwealth.

Admissions to the Dairy Technology Course in 1964, included eight from New South Wales (including three factory apprentices), two from Western Australia, one from Queensland, one from A.C.T., and one from Thailand. Australia-wide employment of the 374 Diplomates from this Course since 1928 has been as follows: N.S.W. 265, Victoria 45, South Australia 18, Tasmania 14, Queensland 15, Western Australia 10, Australian Capital Territory two; and outside Australia five.

Admissions to the Food Technology Course in 1964 included nine from New South Wales, one from Western Australia, and one from Tasmania. First diplomates of the Food Technology Course completed their course in 1952. The 82 diplomates up to 1963 are now employed Australia-wide thus: N.S.W. 48, Victoria 17, South Australia three, Queensland one, Tasmania three, Western Australia one; and overseas nine.

WORKS AND IMPROVEMENTS

Extensive electrical re-wiring has been done.

The original "Mechanics" Lecture Room has been completely renovated; most of the original room has been converted into a first class tiered lecture theatre, seating 88 students, and the remainder of the space has become an Engineering Demonstration Room. The College laundry has been completely renovated and most of the machinery replaced.

The Agronomy storage shed has been completed and this building includes dehydrator space, machinery, chemical, tool, seed, fertilizer and herbicide rooms, as well as lunch and toilet amenities for the field staff. The old Vegetable Garden Shed was replaced with a larger, superior structure.

A demonstration shed at the Piggery, primarily for use in student instruction, was completed.

A new saw-tooth laying-cage shed and a new rearing shed were constructed in the Poultry Section.

In the Sheep Section the first stage in modifying the old shearing shed was completed, providing a new office for the Lecturer in Sheep Husbandry and an adjacent saddle room.

At the Dairy, a new laboratory for milking machine research was erected adjacent to the bails.

Sectional Operations at Hawkesbury

FARM SECTION

Season and Cropping.—In the five months January to May, 1963, 31.35 inches of rain was recorded. The waterlogged ground conditions throughout autumn and winter seriously limited the area of winter crops and pastures sown.

The moderately dry August/September/October period allowed ground preparation and sowing of summer crops. These generally were very successful, particularly millet and maize for silage production. Hybrid grain sorghum used for student header instruction returned a good yield of 80 bushels per acre.

Heavy rain in June, 1964, gave 1,080 points in nine days and a major flooding of the river and adjacent low areas. The flood losses included five acres of maize for grain, 16 acres of established lucerne, 20 acres of barley and five acres of red clover.

In autumn, 1964, 315 acres were seeded to cereal crops. Establishment was good to fair but heavy rain resulted in an overall loss of 50 acres.

Cereal Rotation.—The cereal rotation is very narrow, some 400 acres being seeded each year on 900 acres of arable land. This is because of stock numbers and feed requirements but must be reviewed soon. Sixty more acres of recently cleared land in Londonderry No. 6 paddock were seeded to oats for the first time this autumn, but this additional area will have little effect to widen the present narrow rotation.

Fodder Reserve.—About 110 tons of cereal hay was used to feed horses, leaving 100 tons in reserve. A hay harvest this season is necessary to build up the reserve.

Forty-five tons of lucerne-pasture hay was produced on the property, while 60 tons of lucerne hay was purchased and 12 tons was received by transfer, for a total of 117 tons. Of this amount 20 tons was utilised by the Sheep Section and 97 tons by the Dairy Section. For comparisons: 238 tons was produced and 53 tons was purchased the previous year. With 25 tons now on hand a total of 217 tons has been utilised over the past financial year.

A 90 tons silo was filled from autumn crop and pasture, and a 130 and a 90 tons silo were filled from millet crops. A favourable maize crop allowed a 90 tons overhead silo to be filled and a 200 tons hillside pit at the Beef Cattle Section to be sealed for fodder reserve. At present 200 tons is held in overhead silos and 600 tons in underground pits.

No wheaten grain was transferred to this College during the year, whereas 67 tons was received from other farms in the previous year. All wheat requirements were purchased from the Wheat Board.

Fifteen tons of oaten grain was received on transfer from other farms while 80 tons was purchased. In all, 90 tons of oaten grain was used for feed at the Dairy, Horse and Sheep Sections, compared to 88.4 tons used in the 1962-63 season. Necessary winter feeding of sheep has increased the use of oats this year. At present 200 bags of feed oats are on hand.

Rice.—Six acres in three-acre bays each of Calrose and Caloro were seeded to rice in early November, 1963. The water was from the town sewage effluent. Stam F.34 was used for weed control. Grain production was moderately good but could not be harvested, due to lack of a suitable header. It is proposed to have four three-acre bays with a three-acre rice/pasture rotation, and to utilise this effluent water until previously proposed irrigation plans materialise.

Lucerne.—Twenty acres of lucerne and 15 acres of white clover which can be commanded by water from the Richmond effluent drain were established this autumn. The potential of these areas is good, and some reserve of hay for winter feeding of beef cattle and sheep should be built up this summer.

Fencing.—Dog proof fencing of the Clarendon area was commenced, and 210 chains completed. One and a half miles of internal fencing mostly of small areas has also been completed.

Irrigation.—Electrification of the pump-in and pump-out equipment at the Turkey Nest Dam has greatly improved the efficiency of this system. Building up of the wall of this dam and repair to the Hillside Dam have still to be done, to enable full irrigation of the proposed 66 acres of improved pastures.

Drainage.—Contract cleaning and enlargement of the large drain from Richmond paddocks through Clarendon to Rickaby's Creek has effectively improved the drainage of these areas, but a weed growth problem within the drains remains.

Clearing.—Clearing of 60 acres in Londonderry No. 6 was completed. A further 60 acres in Blacktown 12 will be cleared and should suit cultivation. Considerable clearing remains to be done on land which would suit cattle grazing.

Machinery.—Two Nuffield 460 diesel tractors and a Fiat 411R tractor were purchased. A finger wheel hay rake and a 12 run combine were obtained basically for student instruction. Two Gehl self unloading forage trailers were purchased for silage production.

AGRONOMY SECTION

District Work and Extension Activities.—A number of weed control, vegetable and plant nutrition trials were established by Section staff, locally and in other districts of the State.

Information and advice was given to many people by telephone, letter and personal contact. Enquiries covered a wide range but mainly weed control, vegetable production and plant nutrition. Agronomists addressed field days and farmers' schools at the College and in this and other districts.

The research agronomists also gave some lectures and demonstrations to College students and to visiting University students on subjects in the various fields of research at the College.

Co-operative Research.—Co-operative research work was undertaken with the Universities of New South Wales and Sydney, the C.S.I.R.O. Divisions of Food Preservation and Plant Industry, the Australian Atomic Energy Commission, other Divisions of the Department of Agriculture, commercial firms and private individuals.

The co-operative weeds research programme with Geigy Agricultural Chemicals, for which this firm has located an Experimentalist and a Field Assistant at the College, is working very well.

The Division of Plant Industry section of this Report incorporates notes from the results of agronomy research at this College.

ORCHARD SECTION

All trees produced good growth, and citrus trees were especially prolific with strong autumn growth.

Citrus crops were fairly good, the pear crop was exceptionally good, the stone fruit crops were medium to heavy, the young grapes in the new vineyard produced small crops, and the pecans produced a small crop of good sized nuts.

Extension Work.—A packing demonstration and packing quality talks were staged for the Agricultural Bureau State Congress, a school on general horticulture was held for Junior Farmers, and some extension service was rendered in the surrounding district—mainly as advice to growers enquiring on specific problems. Fruit acidity tests were done at the College for growers.

Research.—Data were again obtained from the Washington Navel Rootstock trial. Yield, sizes of fruit, percentage juice, acidity and total solids are being investigated.

The recording of descriptions of various citrus varieties, in terms of manner of growth and fruiting, has been commenced as a new project.

Development and Reconstruction.—Planting of young trees was maintained by adding a small planting of Navel oranges. The trees were double planted, to provide sufficient trees for student instruction in planting out and the care and pruning of young trees to maturity.

Nursery work has been completed and should provide an adequate number of trees from which to select further plantings.

Peach and apricot trees have been removed from the Yarramundi orchard, leaving only the Washington Navel rootstock trial and Pecan nuts.

HORSES

At the end of June, 1963, horses totalled 70 head. During the year three colts and five mares and fillies were sold; one mare was used for post-mortem and seven head were transferred to other farms. Eight foals were born during the season. At the end of June, 1964, horses totalled 64 head, including three on agistment.

SHEEP SECTION

Lambing, 1963.—Lambing commenced in early June with a trial group of 100 crossbred ewes mated in January. The results were not encouraging, only 56 per cent of lambs being marked.

The first lambing from the merino flock was late in September due to difficulty in delivery of rams for an earlier mating. The result was most promising. Just over 100 per cent lambs were marked.

Mating, 1964.—One hundred and forty crossbred ewes were mated in February to produce lambs that will be early weaned for use in grazing trials in late spring. The commercial flock ewes were mated March-April and the Merino flock April-May. The merino mating was later again this year to spread the work load of lambing and mothering and to enable more students to experience lambing routine. The later merino lambing also enables easier arrangement of fleece weighing demonstrations at shearing of this flock.

Field Demonstrations/Research.—(1) *Production per acre work* was abandoned almost at the outset, due to an unfavourable lambing and other difficulties.

(2) *Evaluation of individual pasture species* for lamb production was commenced in a co-operative trial with the Agronomy section. Groups of early weaned lambs will be grazed on pure sward of pasture. Growth rates and wool growth are to be compared, in association with chemical analyses of pasture and rumen contents, etc.

(3) *Comparison of high and low moisture content pasture* for lamb growth is proceeding in conjunction with the foregoing trial. High moisture pasture will be maintained by constant light irrigations. Duration of the trial will be dependent upon weather conditions.

(4) *Effects of urea supplementation of dry feed* are being demonstrated for students. Three commercial products are here being used; high urea content (30 per cent), low urea content (4 per cent), and very low urea content (0.3 per cent), plus phenothiazine and minerals. The sheep will be regularly weighed and their wool growth compared by dye-banding technique. There is a control group with no supplement.

(5) *Responses to drenching sucker lambs at varying intervals* are being demonstrated for students, on lambs from the commercial flock. Lambs are drenched at three different intervals. All groups, including the control receiving no drench, are to be sold on the same day. Representatives of each group will be retained for slaughter and carcase appraisal demonstrations for the students. Body weights will be regularly recorded.

(6) *Effect of environment on ram growth, development and selection* is being demonstrated to students. Ram hoggets from the merino flock are being run together. In February, 1965, they will be shorn and fleece-weighed. A top 12 to 20 rams will be taken off and split into two groups of equal fleece weights. One group will be paddock grazed under normal conditions. The other group will be housed and intensively fed for 12 months.

Flock Statistics.—At 30th June, 1964, the College flocks totalled 1,131 sheep, including 260 commercial flock ewes, 240 research flock ewes, 166 Merino ewes, 87 rams, and 378 ration sheep and miscellaneous demonstration sheep.

Twenty-six bales of wool were yielded, a total of 7,936 lb. greasy wool returning £1,986.

DAIRY CATTLE SECTION

Friesian Cattle at Shows.—A team of seventeen was exhibited at the 1964 Sydney Royal Show and the College was again, for the fourth successive year, most successful exhibitor, with eleven firsts, seven seconds, four thirds and one fourth. The College also gained Reserve Junior Champion bull.

A heifer sold by auction at the show topped the dairy sale with 700 gns.

The College also gained four firsts, three seconds and one third in the production classes, and three firsts and one second and two thirds in group exhibits.

A team were also shown successfully at the Hawkesbury District Show.

Friesian Stud Statistics.—Births for the year 1963-64 totalled 67, comprising 25 males and 42 females, compared with 71 in 1962-63 comprising 35 males and 36 females. At 30th June, 1964, the stud totalled 173 head, nine more than a year earlier, and the 173 comprised eight adult bulls, seven loan bulls, 54 cows in milk, 10 cows dry, 29 heifers and 65 calves under 12 months old.

Stud Sales.—College Friesian cattle remain very much in demand. This year 29 head were sold for a price average of 85 gns. and total of 2,465 gns. In the 1962-63 season 13 head sold realised 1,633 gns.

Breeding Programme.—An analysis has shown that excluding the sires of purchased stock and foundation stock the Friesian females have been sired by no less than 18 bulls.

Breeding has been predominantly by artificial insemination. Semen from the Friesian bull "Frazae Lord Jewel" has been used extensively, and that of "Sniders Fond Hope King" when possible. "Frazae Lord Jewel" is stationed at Aberdeen Artificial Stock-Breeding Centre and "Sniders Fond Hope King" at the Berry Centre. Both these bulls, imported from Canada, are sons of the sire "Spring Form Fond Hope".

A son of "Frazae Lord Jewel", "Hawkesbury Bonnie Voyageur 2nd", is also stationed at Berry Artificial Stock-Breeding Centre and has been used to some extent on the College Friesian stud.

Herd Production Averages.—The latest available Herd Recording figures, for the period up to 30th June, 1963, show that 53 cows averaged 10,978 lb. of milk, 421 lb. butterfat, and a 3.8 per cent test. The 53 cows comprised 13 x 2 year olds (averaging 8,960 lb. milk, 344 lb. butterfat, 3.8 per cent test), 12 x 3 year olds (averaging 9,695 lb. milk, 388 lb. butterfat, 4 per cent test), 25 x 4-9 year olds (averaging 12,287 lb. milk, 471 lb. butterfat, 3.8 per cent test), and 3 cows over 9 years(averaging 13,940 lb. milk, 475 lb. butterfat, 3.4 per cent test).

Trials and Experiments.—Trials in progress include:—Growth and development studies of Friesian calves; Solids-not-fats in Friesian herd; the identical twin heifer trial. The trial on *Staphylococcus* toxoid vaccination has been completed.

BEEF CATTLE SECTION

Poll Hereford Stud.—This Stud, now totalling 73, comprises 60 females, 3 adult bulls and 10 bulls under 12 months of age.

One of the foundation sires of the stud "Pylana Taurus" is still on loan to the N.S.W. Milk Board, located at Berry Artificial Stock-Breeding Centre; also on loan is "Hawkesbury Taurus 19th".

The College purchased one Poll Hereford bull, "Lincoln Freebooter 2nd", for £470 from Messrs. N. G. Lyons and Sons, "Geenobby", Lincoln, via Wellington.

Commercial Cattle.—The commercial cattle now totalling 55, comprises 29 cows, 25 calves and one bull. Culls from this herd are used as ration cattle.

POULTRY SECTION

Pure Breeders Test.—On discontinuance of the Egg Laying Competition, the Pure Breeders Test was introduced to provide testing facilities for small breeders of pure bred stock. The Second Test commenced on 1st April, 1963, and concluded on 22nd March, 1964. A full report has since been published.

Egg samples for the Third Test were set in the incubator on 21st August, 1963. Production records were commenced on the 141st day after hatching and the test will be conducted until the birds are 500 days old.

Random Sample Laying Test.—The Eleventh Random Sample Laying Test concluded in November, 1963; 462 days from the hatching date of each sample. A full report has since been published.

The Twelfth Random Sample Laying Test began in August. 1963, with a record total of 28 entries.

Random Sample Broiler Test.—The Fourth Random Sample Broiler Test commenced with the setting of eggs in May, 1963, and concluded in August, 1963, when the chickens were nine weeks old. A full report has since been published.

The Fifth Test commenced with the setting of eggs in April, 1964, and will conclude in July, 1964. Twelve entries were received, including one from Victoria and one from Tasmania.

Annual Poultry Farmers Field Day.—Following two postponements because of heavy rain, the Annual Poultry Farmers Field Day was held on Saturday, 14th September, and continued to receive strong support from all sections of the industry.

Poultry Farmers' School.—A Short Term School of Instruction for Poultry Farmers was held from 28th-31st April. Thirty-four poultry farmers attended.

PIGGERY SECTION

Livestock Numbers and Range.—Fifty-nine litters were farrowed. The total of stock at 30th June, 1964, was 215, comprising 10 Tamworths (3 boars, 7 sows), 12 Berkshires (3 boars, 9 sows), 14 Large Whites (4 boars, 10 sows), and 12 Landrace (3 boars, 9 sows).

Three young Tamworth gilts were retained in the herd. The Large White, Berkshire and Landrace herds are now due for extensive replacement.

Two Tamworth, two Large White, one Berkshire and one Landrace boar were introduced from private studs in June, 1964, and should be of benefit in the future breeding programme.

Sales, Stud and Market.—After the general lifting of the Swine Fever quarantine restriction the demand for stud pigs increased considerably. Buoyant prices on the market further pushed up the volume of enquiries. It was impossible to meet all demands.

Thirty-eight stud pigs were sold, for £845, and market sales totlaled 123 for £1,093.

Student Demonstrations.—The demonstration carried out last year on protein feeding was repeated and is nearing completion with similar results. The following demonstrations are currently in progress: (1) Effect of various mineral mixes on growth rate, efficiency and carcase quality; (2) Effective milk feeding; (3) Comparative performance of cross-bred and pure bred pigs; (4) Effect on carcase quality (particularly fat quality) of heavily feeding finishing pigs on maize inadequately supplemented with protein; (5) Temperature effect on production economy; and (6) Early weaning techniques.

APAIRY SECTION

Statistics.—At 30th June, 1964, there were 54 productive hives and 20 nucleus hives, compared with 56 and 10 respectively at 30th June, 1963.

Yield of honey was 960 lb., removed from the hives in January and March to provide extracting demonstrations to Summer School and College students respectively.

General Breeding.—Conditions for most of the spring and summer favoured bee breeding and queen raising.

The use of baby nucleus colonies for queen rearing has permitted a larger number of queen bees to be raised, to meet the increasing demand each year for College-bred queen bees.

Queen Bee Supplies to Beekeepers.—Last season 250 College-bred queen bees were supplied to beekeepers throughout N.S.W. Very favourable reports have been received in regard to their performance and general qualities. Most of the queens supplied were raised from breeding stock developed by controlled mating with instrumental insemination.

Summer School and Field Day.—The Annual Summer School in Apiculture was held from 6th-11st January, 1964.

Demonstrations were given to the Amateur Beekeepers Field Day held at the College on 15th February, 1964.

FOOD TECHNOLOGY SECTION

Diploma Education.—External examinations were carried out by members of the C.S.I.R.O. Division of Food Preservation and Transport and the Department of Agriculture. Eleven students were enrolled in the Food Technology Diploma Course in 1964. Of 42 applications received most students did not have the necessary qualifications.

Tours of commercial food processing plants supplemented the College work.

School for Factory Foremen.—In conjunction with the N.S.W. Food Technology Association, a fifth Winter School for Factory Foremen was successfully conducted at the College. Twenty-six men from industry attended, from four States. Twenty-one firms in diverse sections of the food processing industry were represented.

Processing Operations.—The basic aim of the practical cannery operation is education, not production. However, although production has been notably low in the past year for reasons beyond control of the cannery, the operations produced (using the 30 oz. can as the can unit of quantity) the following: 4,850 cans vegetables, 3,470 cans fruit, 1,280 lb. quick frozen vegetables, 620 lb. dehydrated vegetables, 4,480 lb. jams, 390 cans juices, 425 cans soup, 370 cans tomato sauce, 160 lb. custard powder, 210 lb. jelly crystals, 6 lb. lemon spread, 8,350 lb. fruit pulp, 1,564 quick frozen fowls and turkeys, and miscellaneous other products.

SCHOOL OF DAIRY TECHNOLOGY

Factory Buildings Plant and Equipment.—Considerable new equipment was installed: an 800 G.P.H. Vac. 8 cream pasteuriser; a 25 lb. per minute Novapac automatic butter printer; an hydraulic cheese cutter made by factory engineers; and a pilot model butter worker with 10-15 lb. capacity for research purposes. Other items, supply pending, include: a 15 ton refrigeration compressor; a 50 ton evaporative condenser; a butter packer; and a 1,000 gallon cheese vat, and a pilot cheese-processing plant. The latter is due for early delivery from overseas.

Quality of Milk and Milk Products.—General keeping quality of pasteurised milk supplied for liquid consumption was good. Some reject milk was received from neighbouring factories but mostly the supply has been surplus to Milk Board requirements and used for cheese manufacture. Some was separated for cream, for butter manufacture, and skim milk for spray and roller dried powder.

Bulk of the cream treated was from factory-separated milk. Recently farm-separated cream in cans has been received once per week from the Mudgee district and its mixed quality proved excellent for student grading practice.

Because of the mediocre quality of cream received it has been difficult to manufacture a butter consistently grading at 93 points. Oxidised flavour remains a problem, especially after the cream has been heated.

The general quality of cheese manufactured has been very satisfactory. The College was again the most successful exhibitor at the Sydney Royal Show.

The market for flavoured milk has been limited. Uncertainty of sales, and storage for long periods have been College problems.

Sales of homogenised milk have been consistent but limited.

Manufacture of milk powder has been limited by recent milk shortage.

General quality of the ice cream and ice cream mix have been satisfactory and local sales are steadily increasing. Bulk sales cannot be entered into to any degree because dry ice is not readily available for shippers.

Factory Production Statistics.—This year the factory produced 218,637 lb. butter, 141,196 lb. cheddar and 959 lb. fancy cheese, 2,374 gals. ice cream, 358 bals. cream mix, 36,793 lb. dried milk, 2,531 x ½ pt. cartons flavoured milk, and handled from various sources near to 6,000,000 gals. milk.

DAIRY RESEARCH

Milk Analyses Bibliography.—A bibliography of references on significant milk analysis work over the past 25 years was compiled.

Rapid Methods for Determining Total Solids in Milk.—A detailed study of the standard, gravimetric method for determining total solids has been made. A report on this work has been published.

By using a reduced weight of milk (3gm.), and heating in a mechanical convection drying oven (100 ± 1°C) after evaporation on a rapidly boiling water-bath, the time to complete the test was significantly reduced. Other variations tested were not promising.

For the rapid technique, a lot of work was done using various "additives", e.g., filter paper, acetone and wetting agents, with the sample. None of these proved of value.

A promising technique has been developed using 1 gm. of sample in a 44 mm. aluminium bottle cap. The sample is first heated to apparent dryness on an aluminium hot-plate; about 4 minutes. The test is then completed at 180°C (one minute) in the mechanical convection oven. A thermostatically-controlled hot plate will be tried in an attempt to eliminate the use of the oven.

Milking Machine and Mastitis Relationships.—Data from a field survey of milking machine performance, cowshed management and mastitis have been analysed. Overmilking and milking time were found to be correlated with incidence of mastitis, but no relationship between machine conditions and mastitis was demonstrated.

In a controlled trial at Glenfield Veterinary Research Station a reduced rate of milking was found to be directly associated with increased mastitis.

A comprehensive review article (300 references) concerning the research literature on machine milking and mastitis has been written.

A two channel vacuum stability recorder for field use has been designed and constructed. It provides a big improvement over other means of recording complete machine vacuum characteristics.

An electronic counter for numerically recording vacuum conditions in the machine has been designed and constructed.

A method for measuring and assessing graphs from vacuum stability recordings has been developed and demonstrated.

Cowshed Management Project.—A method to assess indirectly the work components of cowshed performance has been developed and tested under field conditions. Fifty sets of observations using that method have been collected from the milking machine survey officers and are being examined.

Air Flow Meters and Milking Machine Components.—Equipment for testing these has been constructed and installed in the new research laboratory, with other facilities for machine milking studies.

Efficiency of Detergents and Sanitisers.—A new system for cleaning bulk milk vats has been devised, and tested at the College factory.

Foam cleaning has been shown to be impractical on conventional milking machines.

A new system using a nonionic wetting agent in the post milking rinse has resulted in 90 per cent less build up of milkstone than any other system previously used.

Standard potency tests for bactericidal properties of sanitisers are being developed.

Standards of performance for detergents (draft form) are about to be drawn up, as a result of trials using the accelerated detergent tester.

Work on the residue of chemical sterilants in machines as causing flavour defects and affecting methylene blue reductase time has been completed.

Service Work.—Routine testing for thickness of coating of tin nickel alloy proceeded. Components of milking machines were tested for manufacturers. These included releasers, regulators, claws, rubber and plastics.

Routine testing of commercial types of dairy detergents also proceeded.

WAGGA AGRICULTURAL COLLEGE

General

Staff Developments.—The College now has a professional Librarian, shared with the adjacent Agricultural Research Institute; also a Supervisor of Student Training, to ensure that students' practical work is secured to their best advantage; and a part-time Matron.

Approved new positions, not yet filled, include a lectureship in Farm Engineering and a lectureship in Animal Husbandry.

The Principal, Dr. F. C. Butler, in May, 1964, departed for five months overseas. He will present a paper at the 10th International Botanical Congress in Edinburgh, attend the 7th Commonwealth Mycological Conference in London, and also investigate and report on courses of instruction at various Agricultural Colleges in the United Kingdom. In his absence the Deputy Principal Mr. J. R. Sutherland is Acting Principal and Senior Lecturer Mr. K. G. Beirne is Acting Deputy Principal.

Student Enrolment.—The College commenced 1964, its sixteenth year, with a total of 119 students, ten more than the record set in 1963. Of the 54 new students enrolled for First Year, only four were in on minimum qualifications.

Comparisons of current student numbers with each year for the past five years are possible in the following table:—

Student Year	1959	1960	1961	1962	1963	1964
First Year	34	35	32	39	44	54
Second Year	31	31	34	31	37	32
Third Year	29	30	30	27	28	33
Totals	94	96	96	97	109	119
Percentage of Assisted Students	34·0	28·1	27·6	23·7	25·6	28·6

Diploma Examinations, 1963.—Of the 28 Third Year students who sat for the 1963 final examinations, 19 passed at that time and one of them gained Second Class Honours. Six gained their Diplomas as a result of deferred examinations undertaken in February, 1964.

Ex-Students Numbers and Occupations.—The total of Diploma holders since the first group in 1951 now stands at 285. Thirteen others commenced the course at this College but gained their Diploma at other Agricultural Colleges.

The total number of ex-students now stands at 424 as follows:—

W.D.A.	285;	including 27 Honours graduates.
H.D.A.	8;	including 3 Honours graduates.
H.D.A. (Hort.)	4;	including 1 Honours graduate.
Q.D.A.	1	
Non-Diplomates	126	
Total	424	

Records supplied by the Old Boys' Union disclose the following dissection of ex-student occupations:—

(1) Following agriculture—			
(a) On farms		194	
(b) In Government Departments or quasi-governmental Authorities—			
Agriculture	49		
Soil Conservation	12		
Education	4		
A.B.C.	2		
Valuer General	6		
Others	20		
		93	
(c) In Commercial firms		45	
			332
(2) Undergoing further training			13
(3) Left Agriculture			32
(4) Occupation Unknown			44
(5) Deceased			3
			424

Curriculum Trends.—In general, Third Year students in 1964 followed the old curriculum except that Surveying-Building Construction was transferred from Second Year into Third Year and Animal Nutrition and Genetics was transferred from Third Year into Second Year.

The optional Stage II Woolclassing course conducted at night has been popular. Two-thirds of the Year having elected to take it.

The Second Year curriculum in 1964 is the same as that followed for the first time in 1963 excepting that a theory and practical course of Oxy-acetylene and Electric Welding has been commenced in 1964. Applied Biology covering economic and control aspects of pests and diseases, attempted for the first time in 1963, is being further developed during 1964.

In First Year, 1963, experience indicated that junior students as a whole were as capable of handling Anatomy-Physiology as were senior students in the past. However, expanded and deepened science courses in First Year, particularly in Biology, have proven too much for the weaker students as indicated by the 1963 final examinations and the 1964 May examinations. This supports the highly desirable general raising of entrance and course standards which is the policy of the Department as recommended by the Agricultural Colleges Advisory Committee.

The English Expression course of 30 lectures in First Year 1963 notably improved the levels of students' comprehension, written expression and study technique. Following this success a S.R.A. Reading Laboratory IVA has been acquired for use in an expanded course.

Apiculture has been retained as a part of the First Year curriculum in spite of earlier moves to have it made a Third Year elective.

External, Lecturing Aid.—As in previous years, the Wagga Technical College assisted with lectures and demonstrations in Bookkeeping, Farm Engineering, Tractor Maintenance, Surveying and Building Construction, Woolclassing, Woodwork and Metalwork. The new welding course in 1964 is also being conducted by Wagga Technical College.

Members of the staff of the Southern Regional Office in Wagga provided instruction in Farm Management to senior years and to first year students in Apiculture.

Senior students again received the benefit of instruction in shearing from outside specialists. I.C.I.A.N.Z. provided demonstration to Third Year students on the use of explosives in Agriculture.

During the Principal's absence overseas, with the Botany Lecturer and Deputy Principal acting as Principal, lectures and demonstrations to Third Year in Agricultural Botany are being conducted by two specialist officers of the Agricultural Research Institute.

Student Tours and External Work.—Third Year students spent five days on tour in the central slopes, tablelands and coastal regions during the 1963 September vacation. Second Year students made the annual four day tour of the Gundagai-Tumut-Batlow-Tumbarumba region in November, 1963.

Senior students gained experience as stock attendants and in judging competitions at the Sydney Royal Show, the Wagga Wagga Show, the Wagga Ram Show and Sales, the Albury Sheep Show, and the Merino Ewe Breeders competition.

Half-day and one-day visits were made to local and district studs, also to properties for Farm Management surveys, and the Wagga Soil Conservation Research Station was visited.

Short Term Schools.—The 13th Annual Junior Farmers' School in Wheat and Sheep Husbandry was attended by 16 young farmers in September, 1963. Also during the August-September vacation a party of 58 Second Year Sydney University students received two weeks' tuition in Animal Husbandry and Farm Machinery.

Works and Improvements

Student Accommodation and Facilities.—The year provided the Official Opening of the new accommodation block, named Doman Block after the College's foundation Principal, Mr. B. Doman.

One of the oldest accommodation blocks, Western Block, was completely renovated.

Work commenced on the College 33 metre swimming pool and wading pool, expected to be completed for the 1964-65 summer. Funds for the pool, likely to cost about £23,000, were in part provided by staff and student efforts over the last five years. A grant of £16,000 has been made by the State Government.

Administrative Accommodation.—Extensions to Graham Block were completed, providing offices for the Deputy Principal and the Registrar, and a room to house an automatic telephone exchange to serve both the College and the Agricultural Research Institute.

An old weatherboard dormitory block was converted into a store and stores' office and all College stores are now centralised there. The original College store, too small, has been converted into the students' sports store.

Water Supply.—To make the College water supply systems adequate, 3,760 ft. of 4 in. mains were laid within the College boundaries and the water supply main to the College was duplicated. The booster pump and electric motor were replaced by more efficient units with double the original pumping power.

Irrigation Project.—A tender was accepted for land preparation for flood irrigation, as the final stage in the irrigation area project. All spray irrigation equipment has been supplied and this section commenced operating on 21st November, 1963. An area of 34 acres is now irrigable, using 1,400 ft. of aluminimum spray lines fitted on "power shift" units.

Roads.—From an allocation of £1,000, a number of internal roads were reformed and gravelled. About 100 yds. of the road fronting the old Dairy was kerbed and guttered and an additional 32 chains of road was sealed.

Fencing.—1½ miles of old boundary fencing was replaced and 2 miles of subdivision fencing was erected.

Farm and Sectional Buildings, etc.—New buildings on various sections included a new Farm Foreman's office and store; three all steel hay sheds; a modern poultry killing unit at a cost of £3,000; and a liquid immersion unit and cold storage room, at a cost of £2,500, to enable proper storage of dressed birds; new stables, feed and harness rooms in the stud horses section; and a glasshouse to improve facilities to raise potted plants and shrubs for College landscaping.

Sectional Operations at Wagga College

Farm Section.—The favourable season for cereals produced high yielding crops:—

Crop	Area	Production	Yield Average
	acres	bus.	bus. per acre
Wheat	135	5,220	38·6
Oats	189	7,610	40·3
Barley	22	855	38·8
	346	13,685	39·5

Ninety-five tons of cereal hay was harvested and 80 acres of oats used for green fodder grazing; 280 tons of cereal silage was conserved. Sixty-five tons pasture and 20 tons lucerne hay were conserved.

Sheep Section.—The section continued co-operative stocking rate experiments with the C.S.I.R.O., and undertook co-operative work with the Agricultural Research Institute to demonstrate the effect of pasture oestrogens on sheep breeding.

College sheep gained five placings from eight entries at the Wagga Show.

Stock numbers have been reduced slightly, because of reduced grazing area due to re-organization of the Stud Horse section and expansion of Agricultural Research Institute trials. This trend is expected to continue.

Horse Section.—There were 58 head at 31st May, 1964, two less than a year ago. The 58 comprised three entires, 29 mares, 18 geldings and 8 foals.

Four stallions, three mares and one foal were sold to private enterprise for a total of £1,312.

Twenty mares were accepted for service and fees totalled £444.

The Stud gained Reserve Champion mare, two Firsts, two Seconds and a third prize at the 1964 Sydney Royal Show.

Beef Cattle Section.—The Stud continued to improve in standard and this will be reflected during 1964-65 in sales of bulls. At 31st May, 1964, there were 64 head, five more than a year ago. The 64 comprised 12 stud bulls and 52 stud cows. Also in the section were nine grade steers and seven grade cows.

Piggery Section.—The swine fever quarantine was lifted in March, 1964, and swine fever group pigs were slaughtered. Some trouble was experienced with Rhinitis for several months in 1964. At 13th June, 1964, there were 84 pigs, 28 less than a year ago.

Two student demonstrations were carried out: (*a*) carcase differences in groups of porkers fed different rations; (*b*) weight control in brood sows by individual feeding.

Dairy Section.—Production was slightly less than the high levels of the last three years. More young cows in the herd, and unfavourable summer and early autumn conditions were the reasons.

Progeny of the imported bulls continue to show out well and grand-daughters now milking are producing satisfactorily. "The Mounts Orange Boy" (Imp.) is still being used lightly by artificial insemination. Top production cow for the year, "Wagga Golden Lotus", a six year old daughter of "St. Cloud Golden Baron", produced 11,100 lb. milk testing 5.6 per cent and 620 lb. of butterfat.

Herd average for the last ten years now exceeds 8,000 lb. milk and 400 lb. butterfat per year, a very creditable performance.

Natural increase was 31 males and 28 females, including two stillborn calves or abortions. Three male and one female calves born were by artificial insemination. The herd total was 141 at 30th June, 1964. A strong demand continues for stud stock, the demand for bulls exceeding supply.

Fifteen stud males and twelve stud females were sold for a total of 1,311 guineas. Ten head were culled to the commercial herd. These included six aged cows culled for breeding or mastitis. Twelve head died; seven were young calves.

Three further bulls were loaned to the Sydney University and three were returned. Two stud bulls were consigned for slaughter direct from the University and one is still being used by the Veterinary Physiology Department.

A young stud bull was exchanged for a five year old son of "The Mounts Orange Boy" from a Lismore farmer. This particular bull from a very sound "Yanco" family was selected from several such sons around the State, and is being used in the breeding programme.

Sales of milk and cream returned £2,863.

An exhibit of College Jerseys at 1963 Wagga Show gained 12 First placings, 11 Second placings, the award of Best Dairy Cow, Champion Jersey Cow and Champion Jersey Bull.

The solids-not-fat trial has been continued, with satisfactory results. Birth weights and measurements of calves have also been continued and may be expanded soon into a full Growth and Development project.

Apiary Section.—The College Apiary has been evenly maintained although throughout the Riverina there have been medium to heavy losses in privately owned apiaries.

Four queens were received into the apiary, one from Hawkesbury Agricultural College. Five were bred from these. Three other queens from outside sources were received too late but will be used for breeding in the spring of 1964.

Two new types of hives have been designed and built at the apiary and trials on these will commence in spring, 1964.

Poultry Section.—Fowl pox vaccinations were completed but annual pullorum testing has been delayed.

Respiratory diseases have been absent from the turkeys this year but widespread again in the fowls. Investigations to determine and correct causes of poor fertility, poor hatchability and poor poult survival in turkeys have been commenced but no results to date.

An investigation into turkey egg storage and hatchability has been started. Early results have been very interesting. A report will be made when further results have been recorded.

GRAHAME EDGAR, Director-General.

30th September, 1964.

APPENDICES

I. Accounts of the Department of Agriculture, 1963-64.

II. The Published Matter of Officers of the Department of Agriculture, 1963-64.

APPENDIX I

The Accounts of the Department of Agriculture, 1963–64

The cost of maintaining the Department of Agriculture is met from the Consolidated Revenue Fund, whilst capital expenditure on buildings and permanent improvements to departmentally-owned property is financed from the General Loan Account. In addition to these general classifications of expenditure, the Department is assisted in the financing of certain specified lines of research and development and the control of insect pests and animal diseases by direct levies on industry and by grants from the Commonwealth Government and public and private organisations. Operations of this nature are reflected in a large number of separate accounts within the general Treasury classification of " Special Deposits Account ", some details of which are given elsewhere in this Appendix.

COMPARATIVE STATEMENT OF EXPENDITURE

Account	1962-63	1963-64	Increase or Decrease
	£ s. d.	£ s. d.	£ s. d.
Consolidated Revenue Fund	4,757,618 14 0	5,876,528 12 8	1,118,909 18 8 (Increase)
General Loan Account	210,831 14 2	158,853 10 2	51,978 4 0 (Decrease)
£	4,968,450 8 2	6,035,382 2 10	£1,066,931 14 8 (Increase)

EXPENDITURE FROM CONSOLIDATED REVENUE FUND

The following tabulation is a comparison of expenditure by the functional Divisions of the Department for the last two financial years :—

Division	1962-63	1963-64	Increase or Decrease
	£ s. d.	£ s. d.	£ s. d.
Central Administration	1,071,901 6 10	1,903,898 6 9	831,996 19 11 (Inc.)
Science Services	213,742 19 6	222,819 13 4	9,076 13 10 (Inc.)
Plant Industry	273,615 10 3	276,373 19 8	2,758 9 5 (Inc.)
Horticulture	243,866 1 11	269,532 0 11	25,665 19 0 (Inc.)
Dairying	237,936 6 3	248,958 9 2	11,022 2 11 (Inc.)
Hawkesbury Agricultural College	268,077 5 2	289,837 0 8	21,759 15 6 (Inc.)
Wagga Agricultural College	131,847 14 11	146,713 16 4	14,866 1 5 (Inc.)
Experiment Farms and Stations	462,889 11 4	572,766 0 6	109,876 9 2 (Inc.)
Animal Industry—			
Head and District Offices	674,476 14 3	768,672 11 5	94,195 17 2 (Inc.)
Queensland Border	94,432 10 6	102,673 17 6	8,241 7 0 (Inc.)
Tick Quarantine Areas	943,888 15 8	893,126 0 7	50,762 15 1 (Dec.)
Royal Botanic Gardens	140,943 17 5	181,156 15 10	40,212 18 5 (Inc.)
Totals £	4,757,618 14 0	5,876,528 12 8	1,118,909 18 8 (Inc.)

Of the increase of £1,118,909 11s. 8d. a recoverable advance to the Grain Elevators Board of New South Wales accounts for £1,000,000.

EXPENDITURE FROM GENERAL LOAN ACCOUNT

Expenditure from General Loan Account for the year was £158,853 10s. 2d. and of this £15,363 19s. 6d. was spent on a new administration building at Trangie Agricultural Research Station; £29,474 14s. 0d. on further requirements for the establishment of a training centre for the new Farm Certificate Course at Yanco Agricultural Research Station; and £16,900 on the establishment of a veterinary Diagnostic Centre at Armidale.

The following are details of amounts expended from General Loan Account during the financial year 1963-64 on works at various Institutions of the Department:—

	£	s.	d.
Hawkesbury Agricultural College—			
Cottage	5,000	0	0
Poultry Buildings	5,127	1	3
Remodelling of Kitchen	117	0	11
Wagga Agricultural College—			
Extensions to Wagga Agricultural Research Institute	4,242	10	9
Soil Testing Shed—Research Institute	754	7	7
Extensions to Graham Block	3,185	7	0
Electrical Installations	2,180	0	0
Two new Hay Sheds	1,500	7	0
New Dormitory Block	8,570	2	11
Poultry Slaughterhouse	6,080	17	4
Swimming Pool	8,904	1	8
Two Cottages	10,000	0	0
Experiment Farms and Stations—			
Alstonville Tropical Fruit Research Station—			
New Fruit Packing Shed		8	0
Cowra Experiment Farm—			
Mouse-proof Grain Shed	1,600	0	0
Dareton Agricultural Research Station—			
Machinery Shed and Garage	2,323	4	0
Cottage	5,075	0	0

	£	s.	d.
Griffith Horticultural Research Station—			
Packing Shed	3,419	7	6
Leeton Agricultural Research Station—			
Grain Shed	1,360	0	0
New Administration and Laboratory Block	27	3	6
Narara Horticultural Research Station—			
Glasshouse	3,004	3	6
Narrabri Experiment Farm—			
Cottage	5,000	0	0
Glasshouse	2,961	10	0
Mouse-proof Grain Shed	2,600	8	1
Orange Agricultural Research Station—			
Glasshouse	2,892	4	0
Machinery Shed	2,570	0	0
Seven Hills Poultry Research Station—			
Cockerel Rearing and Holding Pens	2,120	0	0
Trangie Agricultural Research Station—			
Cottage	358	7	6
Machinery Shed and Mechanics Shop	4,510	0	0
New Administration Building	15,363	19	6
Yanco Agricultural Research Station—			
New Farm Certificate Training Centre	29,474	14	0
Division of Animal Industry—Head and District Offices—			
Glenfield Veterinary Research Station—			
Extensions to Laboratories	1,631	4	2
Armidale Veterinary Diagnostic Centre	16,900	0	0
	£158,853	10	2

COMMONWEALTH UNEMPLOYMENT RELIEF GRANT

The Department was allotted £40,000 from the special Commonwealth Unemployment Relief Grant for 1963-64 and a balance of £3,386 12s. 10d. was carried forward from the previous year; £43,342 18s. 9d. was expended on the following works:—

	£	s.	d.
Pastures Protection District (Western Division)—			
Maintenance of Public Watering Places	4,661	13	2
Hawkesbury Agricultural College—			
Agronomy Shed	7,066	7	2
Wagga Agricultural College—			
Electrical Installations	95	0	0
Feed Storage Buildings	50	0	0
Foreman's Office and Store	3,721	0	0
Installation of new pump, &c.	411	14	11
Experiment Farms and Stations—			
Condobolin Experiment Farm—			
Grain Shed	1,628	3	4
Tar Sealing Main Drive	3,050	0	0
Cowra Experiment Farm—			
Tar Sealing Drive	1,539	0	0
Glen Innes Agricultural Research Station—			
Maize Shed	1,053	12	0
Griffith Horticultural Research Station—			
Men's Amenities Building	344	0	0
Narrabri Experiment Farm—			
Tar Sealing Main Drive	2,273	9	5
Tamworth Agricultural Research Station—			
Plant Breeder's Shed	1,153	4	0
Machinery Shed	2,106	0	0
Temora Experiment Farm—			
Hay Shed	766	16	6
Tar Sealing Main Drive	990	16	7
Trangie Agricultural Research Station—			
Fodder Stores	3,010	0	0
Grain Silos	443	18	5
Woolongbar Agricultural Research Station—			
Slaughterhouse	4,375	5	6
Division of Animal Industry—Head and District Offices—			
Glenfield Veterinary Research Station—			
Garage and Implement Shed	2,028	2	6
Royal Botanic Gardens and Allied Activities—			
Improvement Centennial Park	2,574	15	3
Balance carried forward to 1964-65	43	14	1
	£43,386	12	10

OTHER ACCOUNTS

Special Deposits Account

Following is a complete list of accounts and funds within the Special Deposits Account at the Treasury on which this Department operates:—

Name of Account	Balance as at 1st July, 1963	Receipts 1963-64	Payments 1963-64	Balance as at 30th June, 1964
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Advances to Officers for Purchase of Motor Cars	*Dr.* 114,880 0 11	54,825 6 7	63,028 6 10	*Dr.* 123,083 1 2
Potato Growers' Licensing Act, 1940	1,275 19 8	1,784 4 10	2,115 12 3	944 12 3
Commonwealth-State Flood Relief Scheme, 1964	....	60,000 0 0	750 0 0	59,250 0 0
Commonwealth-State Flood Relief Scheme, 1963	49,803 7 9	30,000 0 0	68,846 2 9	10,957 5 0
Balance of Salaries Adjustment Suspense Account	46,861 18 10	68,701 7 8	46,873 19 1	68,689 7 5
Commonwealth-State Flood Relief Scheme, 1961	12,487 19 0	....	12,487 19 0	....
Government Printing Office—Working Account and Stores Account and Sale of Publications	....	1,005 9 10	143 3 9	862 6 1
Noxious Insects Destruction Account	16,027 15 6	79,957 18 6	42,185 15 3	53,799 18 9
Swine Compensation Fund	44,943 0 6	60,815 8 2	12,653 0 2	93,105 8 6
Treasury Fire Risks	....	50 15 0	50 15 0	....
Hawkesbury Agricultural College Canning Factory Account	3,338 9 6	1,815 0 7	2,010 16 6	3,142 13 7
Bush Fire and Flood Relief Account (State)	8,648 13 1	....	100 0 0	8,548 13 1
Hawkesbury Agricultural College—Dairying Factory Working Account	50,774 8 11	195,386 13 5	185,275 5 11	60,885 16 5
Tobacco Industry Trust Account	2,048 10 6	10,000 0 0	11,215 11 5	832 19 1
Pasture Control Account	10,041 7 5	....	....	10,041 7 5
Potato Marketing Board of New South Wales—Funds upon Dissolution Account	295 3 10	11,139 11 3	10,044 5 3	1,390 9 10
Unclaimed Moneys Account	1,346 11 8	312 13 4	746 11 11	912 13 1
Commonwealth Grant towards the promotion of Improved Practices in the Dairying Industry	12,348 3 3	89,398 1 0	86,402 5 6	15,343 18 9
Commonwealth Grant—Expansion of Agricultural Advisory Services—New South Wales	9,621 15 6	78,718 17 10	74,046 5 5	14,294 7 11
Cattle Compensation Fund	726,289 9 7	303,024 19 5	301,401 15 10	727,912 13 2
V.P. Bragg Scholarship—Wagga Agricultural College	27 4 8	307 10 0	132 6 4	202 8 4
Wagga Agricultural College Swimming Pool Account	1,774 12 10	843 10 0	1 15 0	2,616 7 10
Wheat Industry Stabilisation Fund (Disposal) for Research and Extension in the Wheat Industry	117,961 0 0	....	108,039 3 2	9,921 16 10
V.P. Bragg Scholarship Account (Investment)	6,000 0 0	....	....	6,000 0 0
Wagga Agricultural College Swimming Pool Account (Investment Account)	5,500 0 0	....	....	5,500 0 0
Potato Marketing Board of New South Wales—Investment Upon Dissolution Account	10,900 0 0	....	10,900 0 0	....
Wheat Industry Stabilisation Fund (Disposal) for Research and Extension in the Wheat Industry (Investment Account)	....	95,731 0 0	....	95,731 0 0
French Bean Seed Marketing Board of New South Wales—Dissolution Poll	*Dr.* 8 9 4	11 19 9	3 10 5	....
Lemon Marketing Board for the State of New South Wales—Poll on question of Constitution of a	*Dr.* 149 18 8	176 0 4	26 1 8	....
Wine Grapes Marketing Board Triennial Elections	13 5	....	13 5	....
Overseas Trip by Dr. A. T. Pugsley	....	159 3 3	159 3 3	....
Additional Poultry Housing for Random Sample Tests at Hawkesbury Agricultural College	*Dr.* 3,176 3 10	635 4 9	....	*Dr.* 2,540 19 1
Swine Fever Outbreak—Payment of Compensation	*Dr.* 50,000 0 0	....	....	*Dr.* 50,000 0 0
Hawkesbury Agricultural College Trust Account	8,174 2 8	9,582 10 1	9,792 15 6	7,963 17 3
Wagga Agricultural College Trust Account	1,999 11 11	2,712 10 1	1,980 18 10	2,731 3 2
Yanco Agricultural Research Station Trust Account	695 15 9	1,692 0 0	764 8 8	1,623 7 1
Advertising—Department of Agriculture Publications Account	233 4 9	757 0 0	990 4 9	....
Australian Turkey Federation—Contribution for Extension of Facilities at Wagga Agricultural College Turkey Demonstration Centre	209 15 11	....	209 15 11	....
Banana Research Committee Grant for Research	1,047 12 0	1,500 0 0	1,898 13 0	648 19 0
Board of Tick Control Employees' Proportion of Contributions to Local Government Superannuation Scheme	6,443 2 6	19,585 19 7	18,603 0 10	7,426 1 3
Brown Rot Investigations—Trust Fund	720 14 4	....	18 5 9	702 8 7
Commonwealth Contribution towards cost of Investigation into excess Spray Residue on Fruit	*Dr.* 287 6 6	5,087 6 6	4,739 18 5	60 1 7
Commonwealth Grant—Milking Machine Components Testing Station	620 17 1	....	221 3 3	399 13 10
Commonwealth Unemployment Relief Grant	3,386 12 10	40,000 0 0	43,342 18 9	43 14 1
Contributions by Industry towards Research into Meat Meal quality at Seven Hills Poultry Research Station	1,000 0 0	7 7 0	661 14 2	345 12 10
Contribution by States towards Salary and Expenses of Patrol Officer, Grasshopper Control	250 5 10	375 0 0	24 6 0	600 19 10
Contributions to Animal Insect Pest Investigations—Glenfield Veterinary Research Station	521 13 11	....	....	521 13 11
Contributions to Pasture Research—Mid-Coast and Hunter Region	816 6 9	1,500 0 0	1,249 17 7	1,066 9 2
Contributions towards establishment of Library at Agricultural Research Institute, Wagga	8 6 2	....	....	8 6 2

Special Deposits Account—*continued*

Name of Account	Balance as at 1st July, 1963	Receipts 1963-64	Payments 1963-64	Balance as at 30th June, 1964
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Contributions towards development of Tamworth Experiment Station	675 2 4	....	....	675 2 4
Department of Agriculture Suspense Account	6,956 0 7	103,972 5 3	100,683 14 2	10,244 11 8
Donation by I.C.I.A.N.Z. towards Pasture Fertilizer Notrogen Investigations	246 13 6	....	....	246 13 6
Geigy Agricultural Chemicals Contribution towards Weedicide Research Project at Hawkesbury Agricultural College	92 14 7	....	....	92 14 7
Hawkesbury Agricultural College Egg Laying Competition Prize Fund	316 10 1	1,084 2 6	1,035 17 4	364 15 3
Horse Breeding Fund	142 18 10	....	142 18 10	....
Legume Inoculant Association Contribution towards Research and Service in the field of Rhiziobiology	2 14 6	....	....	2 14 6
Manning District Agricultural Research Council Contribution for Pasture Research in the Manning District	166 12 4	1,200 0 0	1,372 13 8	*Dr.* 6 1 4
Overseas visit by Dr. Grahame Edgar	....	1,876 5 0	1,876 5 0	....
Pender W.S. Memorial Fund—Interest on Bonds	49 7 9	49 16 9	53 2 6	46 2 0
Reserve Bank of Australia Grant from Rural Credits Development Fund towards Whole Farm Feed Year Studies	474 13 11	830 0 0	1,287 8 11	17 5 0
Rick Research Laboratory, Yanco	286 0 0	....	263 10 0	22 10 0
Shannon Vale Nutrition Station Working Account	7,951 12 1	8,581 8 1	3,098 9 11	13,434 10 3
The Sulphur Institute of U.S.A. Grant for Compilation, &c., of Results of U.P.S.E.T. Trials	2,207 9 4	1,002 15 3	1,925 19 9	1,284 4 10
Tobacco Extension Grant to finance additional Extension Work	3,269 12 6	3,270 0 0	2,671 15 11	3,867 16 7
Tropical Fruit Research Station	3,143 7 4	....	373 8 5	2,769 18 11
Unclaimed Salaries and Wages	568 8 3	1,125 17 11	1,501 6 3	192 19 11
Australian Cattle and Beef Research Committee—Grants—				
Pasture Species Investigations with particular reference to Summer Legumes	714 7 2	5,853 12 10	5,280 17 4	1,287 2 8
Major and Minor Element Deficiencies in Soils from Beef Areas	725 0 0	1,500 0 0	991 8 0	1,233 12 0
Phosphate Levels in North Coast Soils with specific relation to Summer Legumes	487 10 0	2,262 10 0	2,374 6 4	375 13 8
Pasture Intake and Digestibility Studies—Production of more beef per acre on Irrigated Pastures	*Dr.* 443 8 10	2,499 4 10	2,248 18 9	*Dr.* 193 2 9
Winter Nutrition on Northern Tablelands	3,598 5 9	6,540 0 0	9,847 9 4	290 16 5
Nature and Organisation of the Australian Beef Cattle Industry	186 7 2	800 0 0	883 17 5	102 9 9
Beef Cattle Improvement through Breeding Methods	....	5,950 0 0	5,257 11 0	692 9 0
Australian Dairy Produce Board—Grants for Research Projects—				
Socio-Economic Investigations	*Dr.* 18 6 10	3,926 1 6	5,474 17 6	*Dr.* 1,567 2 10
Expansion of Pasture Species Research	534 7 2	2,000 0 0	2,458 11 2	75 16 0
Expansion of Other Pasture and Animal Research	*Dr.* 24 12 11	7,500 0 0	9,711 2 7	*Dr.* 2,235 15 6
Dairy Manufacturing Research Problems of Blue Vein Cheese Production	1,194 12 5	....	759 4 7	435 7 10
Bacteriophage Antibiotic Interactions	....	2,000 0 0	26 4 0	1,973 16 0
Composition of Milk	590 14 0	4,000 0 0	4,776 18 7	*Dr.* 186 4 7
Efficiency of Detergents	514 16 11	2,000 0 0	2,743 4 7	*Dr.* 228 7 8
Wheat Industry Research Committee of New South Wales—Grant for—				
Expanded Wheat Research Projects—Wagga Agricultural Research Institute—Agronomic Survey	685 8 11	7,200 0 0	7,238 0 1	647 8 10
nvestigation of Black Soil Scarab	221 0 5	500 0 0	326 16 3	394 4 2
Purchase of Brabender Quadrumat Junior Mill	....	950 0 0	829 13 7	120 6 5
Cropping Trial	351 16 1	....	199 13 9	152 2 4
Frost Resistance Investigations, Agricultural Research Station, Tamworth	1,349 1 0	....	1,349 1 0	....
Genetic Analysis of Physiological Components of Maturity in Wheat	....	600 0 0	300 11 5	299 8 7
Insulation and Refrigeration of Cold Room and Heating of Glasshouse, Tamworth	....	1,200 0 0	132 0 0	1,068 0 0
Laboratory Equipment, Wagga Agricultural Research Institute	....	1,500 0 0	....	1,500 0 0
Mechanism of Frost Resistance in Wheat	....	650 0 0	431 13 7	218 6 5
Skeleton Weed Research	756 5 9	1,700 0 0	1,360 2 7	1,096 3 2
Soft Wheat Quality Programme—Central West	2,488 2 4	3,250 0 0	3,449 13 2	2,288 9 2
Soil Fertility	574 13 4	600 0 0	1,099 15 1	74 18 3
Travel and Capital Expenditure—Dr. A. T. Pugsley and G. M. Halloran	1,700 0 0	264 17 0	1,228 8 9	736 8 3
Visit to New Zealand of a Soil Chemist	7 10 5	....	....	7 10 5
Wheat Granularity	137 3 7	....	....	137 3 7
Wheat Research in the Central West	....	4,000 0 0	5,299 11 3	*Dr.* 1,299 11 3
Breeding of improved Wheat Varieties for Irrigation Areas	500 0 0	2,500 0 0	2,167 5 7	832 14 5
Wheat Yield	192 9 10	....	....	192 9 10

Special Deposits Account—*continued*

Name of Account	Balance as at 1st July, 1963	Receipts 1963-64	Payments 1963-64	Balance as at 30th June, 1964
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Wheat Industry Research Council—Grant for—				
Appointment of Wheat Geneticist at Wagga Agricultural Research Institute	*Dr.* 200 11 1	1,500 0 0	1,299 8 11	....
Investigation into possibilities of Segregation of Wheats on the basis of Quality	906 13 9	1,000 0 0	1,700 4 6	206 9 3
Photo-period and temperature studies	464 18 1	2,500 0 0	2,350 12 1	614 6 0
Tamworth Agricultural Research Station—Equipment	....	5,000 0 0	....	5,000 0 0
Wool Research Committee—Grant for—				
Adaptive Pasture Research—Southern Tablelands	....	2,000 0 0	1,814 15 0	185 5 0
Additional Sheep and Wool Advisory Officers	593 5 8	....	601 10 0	*Dr.* 8 4 4
Comparison of Management Systems	....	3,750 0 0	2,474 5 11	1,275 14 1
Co-operative Research into treatment of non-arable Areas—Serrated Tussock Control	350 9 1	1,776 0 0	1,798 11 5	327 17 8
Efficiency of Wool Production	*Dr.* 35 19 9	2,302 0 0	1,524 17 9	741 2 6
Fleece Measurment for Selection of Stud Merino Rams	272 0 4	6,774 0 0	5,956 3 6	1,089 16 10
Influence of Season on Ram Fertility	23 13 7	327 0 0	544 5 8	*Dr.* 193 12 1
Investigation of Black Soil Scarab	501 6 5	334 0 0	255 3 8	580 2 9
Research in Galvanised Burr Control	462 5 0	....	13 2 0	449 3 0
Research into control of Insecticidal Resistance in Sheep Blowfly	504 7 9	904 0 0	1,067 13 8	339 14 1
Research into control of Itch Mite in Sheep	136 1 9	1,586 0 0	840 17 7	881 4 2
Re-establishment of Shannon Vale Nutrition Station	2,622 4 4	....	474 16 9	2,147 7 7
Sheep Breeding and Pasture Management–Relative Efficiency at Several Stocking Rates and Superphosphate Levels	105 0 7	2,545 0 0	3,795 13 10	*Dr.* 1,145 13 3
£	1,046,221 5 8	1,454,637 5 8	1,345,184 16 8	1,155,673 14 8

Brief details of the legislation covering some of the more important aspects of these accounts, together with short histories of the operations conducted under each of them, were given in the Annual Report of 1957-58.

The following additional information is now offered in respect of such of the accounts as appear to warrant further amplification:—

Swine Compensation Fund

		£ s. d.	
Balance as at 1st July, 1963		5,056 19 6	*Dr.*
Receipts—			
Stamp Duty	60,815 8 2		
Refund Overpayments	63 0 0		
		60,878 8 2	
		55,821 8 8	
Disbursements—			
Swine Compensation		12,716 0 2	
Balance as at 30th June, 1964		(*a*)£43,105 8 6	

(*a*) An amount of £50,000 was advanced by the State Treasury to enable payment of compensation to be made in excess of the amount available in the Fund. At the commencement of the year there was a debit balance of £5,056 19s. 6d., but the year closed with a credit balance of £43,105 8s. 6d., the special advance no longer being needed to meet claims.

Cattle Compensation Fund

Disease	Claims			Animals			Payments		
	Reg. 5	Reg. 6	Total	Reg. 5	Reg. 6	Total	Reg. 5	Reg. 6	Total
							£ s. d.	£ s. d.	£ s. d.
Tuberculosis	1,878	727	2,605	5,449	1,337	6,786	101,828 3 8	38,688 3 4	140,516 7 0
Cancer	4,283	484	4,767	5,919	630	6,549	73,594 6 5	12,505 14 3	86,200 0 8
Actinomycosis	2,670	12	2,682	3,114	15	3,129	37,946 4 5	226 15 6	38,172 19 11
Actinobacillosis	1,080	5	1,085	1,469	5	1,474	16,714 3 1	67 18 9	16,782 1 10
Pleuro Pneumonia Contagiosa	2	..	2	2	..	2	51 0 0	....	51 0 0
Trichomoniasis	12	..	12	57	..	57	756 6 5	....	756 6 5
Tick Fever	..	..	..	..	..	..	....	....	....
Johne's Disease	3	..	3	3	..	3	79 15 0	....	79 15 0
Vibriosis	..	..	..	..	..	..	....	....	....
Totals	9,928	1,228	11,156	16,013	1,987	18,000	£230,969 19 0	51,588 11 10	£282,558 10 10

SUMMARY OF RECEIPTS AND PAYMENTS

	£ s. d.	£ s. d.	£ s. d.
Balance of Fund as at 1st July, 1963	......	......	£726,289 9 7
Add Receipts—			
Levy		210,357 10 10	
Sale of Stamps		92,667 8 7	
Refund Overpayments		89 2 9	
			303,114 2 2
			£1,029,403 11 9
Deduct Payments—			
Compensation		282,558 10 10	
Administration Costs—			
Valuation Fee	5 5 0		
Allowances to Secretaries, Pastures Protection Boards	2,125 0 0		
Department of Agriculture	16,802 2 9	18,932 7 9	301,490 18 7
Balance of Fund at 30th June, 1964	......	......	£727,912 13 2

Commonwealth Dairy Industry Extension Grant

The continuance of this grant has been approved to 30th June, 1965, under the terms and conditions set out in the Department's report for the year ended 30th June, 1953.

The first grant was received in October, 1948, and expenditure to 30th June, 1964, amounted to £1,038,671 16s. 2d.

Item	1948-49 to 1962-63	1963-64	Total
	£ s. d.	£ s. d.	£ s. d.
Organising Officers	162,758 0 9	11,313 10 3	174,071 11 0
General Publicity	89,591 14 5	11,935 11 2	101,527 5 7
Demonstrations	172,347 18 8	4,918 0 8	177,265 19 4
Competitions	7,437 7 4	....	7,437 7 4
Field Days	88 15 7	....	88 15 7
Herd Recording	294,683 17 10	35,600 0 0	330,283 17 10
Artificial Insemination	60,075 15 3	....	60,075 15 3
Statistical Work	18,034 1 9	....	18,034 1 9
Herd Surveys	26.165 6 8	....	26,165 6 8
Punch Card Equipment	30,417 3 10	1,407 1 1	31,824 4 11
Milking Machine Survey	40,270 7 10	10,645 10 5	50,915 18 3
Contribution towards attendance of representative at International Study Centre	400 0 0	....	400 0 0
Contribution towards attendance of representative at Maryland University	806 16 3	....	806 16 3
Milking Machine Testing Station	4,882 14 5	....	4,882 14 5
Survey—Infertility in Dairy Herds	11,121 16 1	....	11,121 16 1
Agricultural Trainees	24,000 0 0	9,000 0 0	33,000 0 0
Sire Survey	3,251 11 10	913 3 7	4,164 15 5
Overseas Visit of Senior Women's Extension Service Officer	1,127 13 11	....	1,127 13 11
Testing Stations—Air-flow Meters	115 14 3	70 16 1	186 10 4
Publication of Book "Weeds"	3,000 0 0	....	3,000 0 0
Overseas Visit—Departmental Officers	1,692 14 0	598 12 3	2,291 6 3
£	952,269 10 8	86,402 5 6	1,038,671 16 2

Commonwealth Grant—Expansion of Agricultural Advisory Services—N.S.W.

The Commonwealth agreed to make grants to the States to permit of the expansion of the Agricultural Advisory Services. Initially the grants were for a five year period ended 30th June, 1957. They have been continued and the current aggreement will terminate on 30th June, 1965. Application has been made by the States for the grants to be continued for a further five year term.

Expenditure to 30th June, 1964, is shown below:—

Item	1952-53 to 1962-63			1963-64			Total		
	£	s.	d.	£	s.	d.	£	s.	d.
Crop and Pasture Demonstrations	91,392	0	4	475	1	7	91,867	1	11
Livestock Demonstrations	30,367	4	7	2,048	8	2	32,415	12	9
Horticultural Demonstrations	16,696	8	6	1,711	18	5	18,408	6	11
Agricultural Machinery Demonstrations	28,375	13	11	5,038	16	3	33,414	10	2
Irrigation Equipment and Demonstrations	1,100	16	5	....			1,100	16	5
Field Assistants and Motor Vehicles	228,222	18	7	32,032	3	8	260,255	2	3
Extension Aid Equipment	48,262	17	11	1,143	18	7	49,406	16	6
Publicity Officers	105,658	16	5	21,771	9	4	127,430	5	9
Production of Agricultural Publications	35,504	17	1	3,459	16	8	38,964	13	9
Production of Agricultural Films	2,870	17	1	....			2,870	17	1
Purchase of Books	10,177	7	6	1,135	8	3	11,312	15	9
Overseas Visits of Agricultural Officers	8,891	16	5	769	10	3	9,661	6	8
Agricultural Trainees and Cadets	69,667	6	7	1,232	12	7	70,899	19	2
Administration	9,569	16	7	1,343	13	10	10,913	10	5
Water and Soil Testing	3,517	10	4	1,883	7	10	5,400	18	2
Totals £	690,276	8	3	74,046	5	5	764,322	13	8

Noxious Insects Destruction Account

The Noxious Insects Act of 1934 provides for the striking of a levy under specified conditions, as a contribution towards the cost of suppression and destruction of noxious insects. Receipts are paid into Special Deposits Account and moneys at the credit of this account are applied by the Minister for the purposes prescribed in the Act.

An outbreak of plague locust occurred during the 1963–64 financial year and it was found necessary to obtain an advance of £50,000 from the treasury to finance operations to combat the outbreak, pending the striking of a levy during the 1964 calendar year.

Following is a statement of receipts and payments for the year 1963-64:—

RECEIPTS	£ s. d.	PAYMENTS	£ s. d.
Sale of Materials	1,802 8 11	Poison and Materials and Sundry Purchases	42,185 15 3
Levies	28,155 9 7		
Treasury Advance (Repayable)	50,000 0 0	Balance as at 30th June, 1964	53,799 18 9
	79,957 18 6		
Balance as at 1st July, 1963	16,027 15 6		
	£95,985 14 0		£95,985 14 0

Potato Growers' Licensing Act, 1940 (as amended)

Transactions on this account for the year 1963-64 were:—

RECEIPTS	£ s. d.	PAYMENTS	£ s. d.	£ s. d.
Balance as at 1st July, 1963	1,275 19 8	Grants to Potato Growers' Association		1,950 0 0
Licence fees	1,784 4 10	Administrative Costs—1962-63—		
		Licenses	110 7 0	
		Postage	55 5 3	
				165 12 3
		Balance as at 30th June, 1964		944 12 3
	£3,060 4 6			£3,060 4 6

Shannon Vale Nutrition Station—Working Account

Statement of Receipts and Payments for the year ended 30th June, 1964:—

Receipts	£	s.	d.	£	s.	d.
Balance at 1st July, 1963				7,951	12	1
Sale of Wool	7,724	9	1			
Sale of Skins and sheep	856	19	0			
				8,581	8	1
				£16,533	0	2

Payments	£	s.	d.
Wages	1,471	4	5
Workers' Compensation Insurance	38	17	3
Payroll Tax, 1962-63	40	7	10
Freight and Cartage	318	8	6
Motor Fuel	16	2	4
Vaccine and Drenches	241	8	1
General Supplies	233	2	8
Electricity Supply	613	0	0
Plant Maintenance and Repairs	125	18	10
Balance as at 30th June, 1964	13,434	10	3
	£16,533	0	2

OTHER ACCOUNTS

Contribution by Milk Board to meet cost of Herd Testing for Tuberculosis

Although these operations are within the framework of the Consolidated Revenue Fund, separate accounts are kept in the Department to show the annual financial result. Following is a Statement of receipts and payments for the year ended 30th June, 1964, in respect of this service:—

Receipts	£	s.	d.
Balance at 1st July, 1963	2	4	8
Contributions by Milk Board	4,997	15	4
Balance at 30th June, 1964	113	0	7
	£5,113	0	7

Payments	£	s.	d.
Salaries	4,240	17	9
Employer's Proportion of Superannuation Contributions	314	1	2
Workers' Compensation Insurance Premium	62	7	0
Payroll Tax	115	3	8
Travelling Expenses	366	9	7
Postage	5	0	0
Printing	9	1	5
	£5,113	0	7

Veterinary Surgeons' Act, No. 25 of 1923 as amended

The Act provides for the establishment of a Board to be called " Board of Veterinary Surgeons of New South Wales ". Fees and penalties collected under the Act are paid to the credit of Consolidated Revenue Fund, from which administrative expenses are met. There were 505 registered Veterinary Surgeons at 30th June, 1964.

Receipts and Payments for the financial year 1963-64 were:—

Receipts	£	s.	d.
Registration Fees	50	8	0
Roll Fees	1,088	8	7
Examination Fees	52	10	0
	£1,191	6	7

Payments	£	s.	d.
Salaries	701	17	6
Members' Fees	130	4	0
Travelling Expenses	10	8	4
Postal Expenses	41	3	5
Fees for examination of Foreign Graduates	42	0	0
Minor Expenses	1	2	11
Excess of Receipts over Payments	264	10	5
	£1,191	6	7

Meat Inspection Service

This service is administered under the Meat Industry Act, 1915, as amended, which makes provision for inspection fees.

Following is a statement of receipts and payments of the Meat Inspection Service for the year ended 30th June, 1964:—

RECEIPTS	£	s.	d.	PAYMENTS	£	s.	d.
Inspection Fees—				Salaries and Wages	306,012	18	9
Regulation No. 7	205,802	17	5	Casual Labour	3,937	6	11
Regulation No. 8	49,838	0	3	Retirement Leave	1,424	8	8
Regulation No. 9	112,171	11	8	Metropolitan Meat Industry Board Officers' Endowment Fund Contribution	3,104	12	4
Regulation No. 10	1,483	13	2	Travelling Expenses	18,785	15	3
				Freight and Cartage	59	7	6
				Postal and Telephone	558	16	0
				General Stores	2,938	16	0
				Gas and Electricity	5	5	0
				Rent	450	5	0
				Printing	122	19	9
				Surplus of Receipts over Payments	31,895	11	4
	£369,296	2	6		£369,296	2	6

Whilst there was a surplus of £31,895 11s. 4d. of receipts over payments overhead expenses amounting to £61,990 1s. 2d. have not been taken into account. These include employer's superannuation contribution, workers' compensation insurance and payroll tax, calculated at 20 per cent of cost of salaries and wages (£309,950 5s. 8d.). Applying this figure results in a deficiency of £30,094 9s. 9d. for the year. This amount is offset by £15,227 the amount by which Meat Inspection Fees owing by the Metropolitan Meat Industry Board at the 30th June, 1964, was greater than that owing at 30th June, 1963.

Fund Created by the Wheat Marketing (Barring of Claims) Act of 1929 (as amended)

REVENUE ACCOUNT FOR THE YEAR ENDED 30TH JUNE, 1964

	£	s.	d.		£	s.	d.
To Miscellaneous Disbursements	80	12	3	By Interest on Investments (including Savings Bank Interest)	2,048	15	3
Commitments	1,800	0	0				
Balance—Net Surplus transferred to Accumulated Funds Account	168	3	0				
	£2,048	15	3		£2,048	15	3

BALANCE SHEET AS AT 30TH JUNE, 1964

LIABILITIES	£	s.	d.	£	s.	d.	ASSETS	£	s.	d.
Accumulated Funds—							Investments in Government Securities (face value)	46,070	0	0
Balance as at 1st July, 1963	46,482	12	11				Balance in Savings Bank	2,229	0	5
Part Commitments as at 30th June, 1964, not required	152	5	8				Interest accrued at 30th June, 1964	548	5	11
Net surplus for year ended 30th June, 1964	168	3	0							
				46,803	1	7				
Commitments as at 30th June, 1964				2,044	4	9				
				£48,847	6	4		£48,847	6	4

STATEMENT OF RECEIPTS—CONSOLIDATED REVENUE FUND—FINANCIAL YEAR 1963-64

Head of Receipt	Net Receipts								
	£	s.	d.	£	s.	d.	£	s.	d.
Receipts for Services Rendered—									
Agricultural Colleges and Farms—									
Rents	27,011	6	11						
Students' Fees	73,827	12	8						
				100,838	19	7			
Fees—									
Public Officers	22	4	0						
Apiary Registrations	2,518	2	10						
Cattle Export	8	3	0						
Grading—Dairy Industry Act	5	15	7						
Licence—Dairy Industry Act	18	0	0						
Registration—Dairy Industry Act	18	3	0						
Dairy Science Schools	880	19	3						
Farm Produce Agents' Act, 1926-1932	289	0	0						
Fertilizer Act, 1934	775	18	0						
Pest Destroyers Act, 1945	1,944	2	8						
Registration of Stock Brands	2,536	11	1						
Registration of Swine Brands	120	9	6						
Stock Foods and Medicines Act, 1940	4,697	14	1						
Veterinary Surgeons' Act, 1923	1,191	6	7						
				15,026	9	7			
Contributions—									
Milk Board—T.B. Testing of Herds	4,997	15	4						
Commonwealth Government—Administration of Plant Quarantine	47,090	4	11						
Commonwealth Government—Administration of Animal Quarantine	20,082	9	6						
Commonwealth Government—Administration of Commerce Act	25,462	2	3						
Commonwealth Government—Maintenance of Gardens at Admiralty House	7,010	5	7						
				104,642	17	7			
Miscellaneous Services Rendered—									
Plant Diseases Act—Inspection Fees and Fumigation Fees	800	18	3						
Meat Industry Act—Inspection Fees	369,296	2	6						
Commonwealth Scientific and Industrial Research Organisation—Subsidy—Vegetable growing at Hawkesbury Agricultural College	500	0	0						
Laundry Fees—Hawkesbury Agricultural College	4,120	2	0						
Certification of Seed	12,427	18	2						
Seed Testing	166	4	6						
Herd Recording	63,847	12	4						
Administration of Cattle Compensation Fund	16,802	2	9						
Commission for Collection of Premiums—Group Assurance Hospitals and Medical Funds	1,634	7	4						
Other Miscellaneous Receipts	14,643	18	1						
				484,239	5	11			
							704,747	12	8
General Miscellaneous Receipts—									
Rents exclusive of Land	4,719	7	0						
Fines and Forfeitures—Forfeiture of Bonds, &c.	3,280	19	6						
Sales of Farm Produce—Farms and Institutions	162,469	12	5						
Sale of Government Property	513	19	3						
Commonwealth Government—Contribution for Cattle Tick Eradication	258,500	0	0						
Repayments to credit of Consolidated Revenue Votes—Previous Years	25,380	3	9						
Miscellaneous Receipts on Account of Interest	158	16	2						
Transfer of Part Balances not required	246	13	9						
Licence Fees—Pastures Protection Act	286	4	0						
Broadcasting Fees	14	10	0						
Gas and Electricity	3,614	10	2						
Lavatory Takings	111	19	7						
Postages	82	8	8						
Telephone Calls (private)	1,002	6	6						
3% Contribution—Pastures Protection Boards	26,564	11	11						
Employer's Liability to State Superannuation Fund	2,090	9	1						
Commonwealth Grant towards Cost of Herd Recording	35,600	0	0						
Other Miscellaneous Receipts	7	1	3	524,643	13	0			
							524,643	13	0
Total Net Receipts £	....			....			1,229,391	5	8

DAIRY PRODUCTS FACTORY—HAWKESBURY AGRICULTURAL COLLEGE

The operations of the Dairy Products Factory during the financial year 1963-64 resulted in a profit of £1,817 6s. 10d Abridged final accounts are set out hereunder:—

Manufacturing and Trading Account

	£	s.	d.		£	s.	d.
Stock on hand at 1st July, 1963	5,522	15	3	Sales	162,879	19	9
Purchases	125,095	8	8	Sundry Other Income	125	13	6
Repairs and Maintenance	3,966	8	4	Stocks on hand at 30th June, 1964	3,151	11	8
Fuel, Light and Power	3,612	7	8				
Water	1,222	12	6				
Salaries and Wages	7,234	13	10				
Workers' Compensation Insurance Premiums	59	11	2				
Payroll Tax	180	17	5				
Superannuation—Employer's Liability	762	1	6				
Depreciation	10,382	11	6				
Sundry Expenditure	201	16	7				
Gross Profit	7,916	0	6				
	£166,157	4	11		£166,157	4	11

Profit and Loss Account

	£	s.	d.		£	s.	d.
Salaries and Wages	3,740	16	5	Gross Profit from Manufacturing and Trading Accounts	7,916	0	6
Payroll Tax	93	10	5	Sundry Income	55	5	3
Workers' Compensation Insurance Premium	30	15	11				
Superannuation—Employer's Liability	212	7	8				
Levies—Butter and Cheese	236	17	10				
Printing and Stationery	73	16	10				
Freight and Cartage	445	10	10				
Laboratory Expenses	132	4	11				
Repairs and Maintenance	374	18	6				
Telephone	121	12	11				
General Expenses	79	10	11				
Depreciation	611	15	9				
Net Profit	1,817	6	10				
	£7,971	5	9		£7,971	5	9

Appropriation Account

	£	s.	d.		£	s.	d.
Balance at 30th June, 1964	24,425	8	4	Balance at 1st July, 1963	13,567	0	1
				Equalisation step up	4,686	0	4
				Proceeds from Sale of Assets	502	13	11
				Expenditure not met from Working Account (power, water, detergents, &c.)	3,852	7	2
				Profit for the Year 1963–64	1,817	6	10
	£24,425	8	4		£24,425	8	4

APPENDIX II

Published Matter*, 1963-64

*Viz.:—Matter printed as Department of Agriculture (D. of A.) booklets, or contributed to and printed as articles either in Department of Agriculture journals (the monthly *Agricultural Gazette of N.S.W.*, quarterly *Review of Marketing and Agricultural Economics*, bi-monthly *Dairy Topics*, monthly *Poultry Notes*, the periodical *Research and the Farmer*) or the journals of other institutions/organisations; and papers published in the proceedings of technical conferences.

The Appendix does not list the many times greater volume of items contributed in the course of extension work through such channels as the Department's weekly printed *Press Copy*, and the regional/district publicity releases for newspapers and radio stations. Indications of the volume of this published matter are included in this report under "Division of Information Services" and "Regional Extension Services".

A. RESEARCH STATIONS BRANCH—FARM MECHANISATION ADVISORY SERVICE

D. of A. Booklets

Drever, J. G. J.—If you have trouble with cracked grain. (Bulletin 45).

Drever, J. G. J. and Gray, C. H.—Solar water heaters on North Coast farms. (Bulletin 43).

Contributions to Journals

Drever, J. G. J. (1963)—The farm mower—care and maintenance. Agric. Gaz. N.S.W. 74 (12): 684-88, 704-7.

Drever, J. G. J. (1964)—The farm tractor—care and management. Agric. Gaz. N.S.W. 75 (1): 746-50, 776.

Drever, J. G. J. (1964)—Grain augers—types, features, recent research. Agric. Gaz. N.S.W. 75 (5): 994-98, 1040-41.

Drever, J. G. J. (1963)—How many acres per hour? Agric. Gaz. N.S.W. 74 (11): 627-30, 651.

Drever, J. G. J. (1963)—Will you have trouble with cracked grain? Agric. Gaz. N.S.W. 74 (9): 532-3.

Drever, J. G. J. (1964)—Preventing accidents on the farm. Agric. Gaz. N.S.W. 75 (6): 1082-86.

Drever, J. G. J. and Atkinson, J. A. (1964)—Winter management of farm vehicles. Agric. Gaz. N.S.W. 75 (4): 935-9, 973.

Tindale, E. and Eastoe, R. D. (Div. A.I.) (1964)—Strategic grazing of pastures for wool production. Agric. Gaz. N.S.W. 75 (1): 756-60.

B. DIVISION OF PLANT INDUSTRY

D. of A. Booklets

Anon.—Cabbage culture. (Bulletin P14).

Anon.—Growing sprouting broccoli. (Bulletin P208).

Anon.—The grading of vegetables. (Bulletin P224).

Fitzsimmons, R. W.—Review of wheat variety trials in N.S.W.—1947-1962. (Bulletin P257).

Hartridge, F. J.—Fodder crops for the Lismore District. (Bulletin P218).

Spencer, R. T.—Asparagus culture. (Bulletin P10).

Walkden Brown, C.—An outline of the wheat growing industry in N.S.W. (Bulletin P54).

Contributions to Journals

Anon. (1964)—Carrots—A profitable crop. Agric. Gaz. N.S.W. 75 (5): 1035-38.

Anon. (1964)—The grading of vegetables. Agric. Gaz. N.S.W. 75 (6): 1087-88.

Anon. (1963)—Grain sorghum—Is row spacing important. Agric. Gaz. N.S.W. 74 (11): 661.

Anon. (1963)—Rhubarb growing. Agric. Gaz. N.S.W. 74 (10): 596-97.

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Autry-Hall, F. (1964)—Manganese toxicity in french beans. Aust. Veg. Res. Newsl. 11: 19.

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Boyle, J. W. (1963)—Soil conservation. Agric. Gaz. N.S.W. 74 (7): 390-93.

Boyle, J. W. and Imrie, B. C. (1963)—Grain sorghum production. Agric. Gaz. N.S.W. 74 (10): 564-69.

Boyle, J. W. and Imrie, B. C. (1963)—Sorghums for forage and fodder. Agric. Gaz. N.S.W. 74 (11): 623-26.

Boyle, J. W. and Imrie, B. C. (1964)—Sorghums in New South Wales. Sorghum Newsl. 7: 2-3.

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Colman, R. L. (1963)—Nitrogen fertiliser response by Paspalum dilatatum Poir. with reference to the requirements for quality forage by dairy cattle on the Far North Coast of New South Wales. Third Aust. Grasslands Conf. Paper 7-1.

Dann, P. R. (1963)—The effect of 5 years of leguminous pasture on subsequent cereal crops and other factors. Third Aust. Grasslands Conf. Paper 8-2.

Fitzsimmons, R. W. (1963)—Disease and frosting of cereals. Agric. Gaz. N.S.W. 74 (10): 578-81.

Fitzsimmons, R. W. (1963)—Wheat variety trials in New South Wales. Agric. Gaz. N.S.W. 74 (10): 546-50.

Gottl, R. (1964)—Three new hybrid tomatoes. Agric. Gaz. N.S.W. 75 (1): 764-67.

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Green, K. R. and Blunt, R. W. (1963)—Galvanised burr. Agric. Gaz. N.S.W. 74 (8): 439-41.

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